

METAL COORDINATION COMPOUND,
LUMINESCENCE DEVICE AND DISPLAY APPARATUS

FIELD OF THE INVENTION AND RELATED ART

5 The present invention relates to an organic
luminescence device (also called an organic
electroluminescence device or organic EL device) for
use in a planar light source, a planar display, etc.
Particularly, the present invention relates to a novel
10 metal coordination compound and a luminescence device
having a high luminescence efficiency and causing
little change with time by using a metal coordination
compound represented by formula (1) appearing
hereinafter.

15 An old example of organic luminescence device
is, e.g., one using luminescence of a vacuum-deposited
anthracene film (Thin Solid Films, 94 (1982) 171). In
recent years, however, in view of advantages, such as
easiness of providing a large-area device compared
20 with an inorganic luminescence device, and possibility
of realizing desired luminescence colors by
development of various new materials and drivability
at low voltages, an extensive study thereon for device
formation as a luminescence device of a high-speed
25 responsiveness and a high efficiency, has been
conducted.

As precisely described in Macromol. Symp.

125, 1 - 48 (1997), for example, an organic EL device generally has an organization comprising a pair of upper and lower electrodes formed on a transparent substrate, and organic material layers including a luminescence layer disposed between the electrodes.

In the luminescence layer, aluminum quinolinol complexes (inclusive of Alq3 shown hereinafter as a representative example) having an electron-transporting characteristic and a luminescence characteristic, are used for example. In a hole-transporting layer, a material having an electron-donative property, such as a triphenyldiamine derivative (inclusive of α -NPD shown hereinafter as a representative example), is used for example.

Such a device shows a current-rectifying characteristic such that when an electric field is applied between the electrodes, holes are injected from the anode and electrons are injected from the cathode.

The injected holes and electrons are recombined in the luminescence layer to form excitons, which emit luminescence when they are transitioned to the ground state.

In this process, the excited states include a singlet state and a triplet state and a transition from the former to the ground state is called fluorescence and a transition from the latter is

called phosphorescence. Materials in these states are called singlet excitons and triplet excitons, respectively.

In most of the organic luminescence devices studied heretofore, fluorescence caused by the transition of a singlet exciton to the ground state, has been utilized. On the other hand, in recent years, devices utilizing phosphorescence via triplet excitons have been studied.

Representative published literature may include:

Article 1: Improved energy transfer in electrophosphorescent device (D.F. O'Brien, et al., Applied Physics Letters, Vol. 74, No. 3, p. 422 (1999)); and

Article 2: Very high-efficiency green organic light-emitting devices based on electrophosphorescence (M.A. Baldo, et al., Applied Physics Letters, Vol. 75, No. 1, p. 4 (1999)).

In these articles, a structure including four organic layers sandwiched between the electrodes, and the materials used therein include carrier-transporting materials and phosphorescent materials, of which the names and structures are shown below together with their abbreviations.

Alq3: aluminum quinolinol complex

α -NPD: N4,N4'-di-naphthalene-1-yl-N4,N4'-

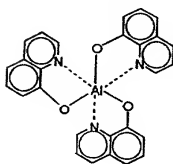
diphenyl-biphenyl-4,4'-diamine

CBP: 4,4'-N,N'-dicarbazole-biphenyl

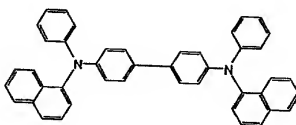
BCP: 2,9-dimethyl-4,7-diphenyl-1,10-phenanthroline

5 PtOEP: platinum-octaethylporphyrin complex

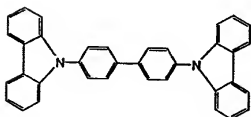
Ir(ppy)₃: iridium-phenylpyrimidine complex



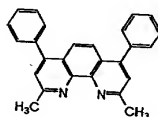
Alq3



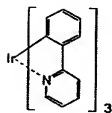
α -NPD



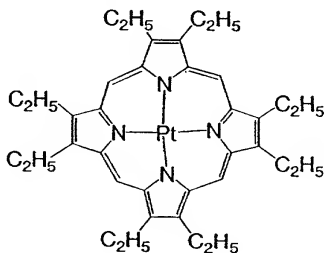
CBP



BCP



Ir(ppy)₃



PtOEP

The above-mentioned Articles 1 and 2 both have reported structures, as exhibiting a high efficiency, including a hole-transporting layer comprising α -NPD, an electron-transporting layer comprising Alq3, an exciton diffusion-preventing layer comprising BCP, and a luminescence layer comprising CBP as a host and ca. 6 % of PtOEP or Ir(ppy)₃ as a phosphorescent material dispersed in mixture therein.

Such a phosphorescent material is particularly noted at present because it is expected to provide a high luminescence efficiency in principle for the following reasons. More specifically, excitons formed by carrier recombination comprise singlet excitons and triplet excitons in a probability ratio of 1:3. Conventional organic EL devices have utilized fluorescence of which the luminescence efficiency is limited to at most 25 %. On the other hand, if phosphorescence generated from triplet excitons is utilized, an efficiency of at least three times is expected, and even an efficiency of 100 %, i.e., four times, can be expected in principle, if a transition owing to intersystem crossing from a singlet state having a higher energy to a triplet state is taken into account.

However, like a fluorescent-type device, such an organic luminescence device utilizing phosphorescence is generally required to be further

improved regarding the deterioration of luminescence efficiency and device stability.

The reason of the deterioration has not been fully clarified, but the present inventors consider as follows based on the mechanism of phosphorescence.

In the case where the luminescence layer comprises a host material having a carrier-transporting function and a phosphorescent guest material, a process of phosphorescence via triplet excitons may include unit processes as follows:

1. transportation of electrons and holes within a luminescence layer,
2. formation of host excitons,
3. excitation energy transfer between host molecules,
4. excitation energy transfer from the host to the guest,
5. formation of guest triplet excitons, and
6. transition of the guest triplet excitons to the ground state and phosphorescence.

Desirable energy transfer in each unit process and luminescence are caused in competition with various energy deactivation processes.

Needless to say, a luminescence efficiency of an organic luminescence device is increased by increasing the luminescence quantum yield of a luminescence center material.

Particularly, in a phosphorescent material, this may be attributable to a life of the triplet excitons which is longer by three or more digits than the life of a singlet exciton. More specifically, because it is held in a high-energy excited state for a longer period, it is liable to react with surrounding materials and cause polymer formation among the excitons, thus incurring a higher probability of deactivation process resulting in a material change or life deterioration.

A luminescence device is desired to exhibit high efficiency luminescence and show a high stability. Particularly, it is strongly desired to provide a luminescence material compound which is less liable to cause energy deactivation in a long life of excited energy state and is also chemically stable, thus providing a longer device life.

SUMMARY OF THE INVENTION

Accordingly, principal objects of the present invention are to provide a luminescence material which exhibits a high luminescence efficiency and retains a high luminance for a long period, and also provide a luminescence device and a display apparatus using the same.

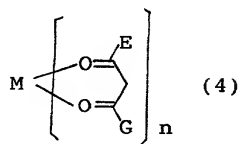
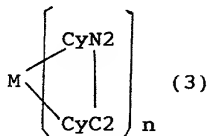
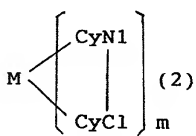
In the present invention, a metal complex is used as a luminescence material, particularly a novel

luminescent metal complex compound comprising iridium as a center metal and an aromatic group of formula (5) appearing hereinafter as a part of a ligand or as a substituent of a ligand.

More specifically, the present invention provides as a luminescence material a metal coordination compound represented by formula (1) below:



wherein M is a metal atom of Ir, Pt, Rh or Pd; L and L' are mutually different bidentate ligands; m is 1, 2 or 3 and n is 0, 1 or 2 with the proviso that m+n is 2 or 3; a partial structure ML_m is represented by formula (2) shown below and a partial structure ML'_n is represented by formula (3) or (4) shown below:



wherein CyN1 and CyN2 are each cyclic group capable of having a substituent, including a nitrogen atom and bonded to the metal atom M via the nitrogen atom; CyC1 and CyC2 are each cyclic group capable of having a substituent, including a carbon atom and bonded to the metal atom M via the carbon atom with the proviso that the cyclic group CyN1 and the cyclic group CyC1 are bonded to each other via a covalent bond and the

cyclic group CyN2 and the cyclic group CyC2 are bonded to each other via a covalent bond;

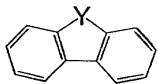
the optional substituent of the cyclic groups is selected from a halogen atom, cyano group, a nitro group, a trialkylsilyl group of which the alkyl groups are independently a linear or branched alkyl group having 1 to 8 carbon atoms, a linear or branched alkyl group having 1 to 20 carbon atoms of which the alkyl group can include one or non-neighboring two or more methylene groups that can be replaced with -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH- or -C≡C-, and the alkyl group can include a hydrogen atom that can be optionally replaced with a fluorine atom, or an aromatic group capable of having a substituent (that is a halogen atom, a cyano atom, a nitro atom, a linear or branched alkyl group having 1 to 20 carbon atoms of which the alkyl group can include one or non-neighboring two or more methylene groups that can be replaced with -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH- or -C≡C-, and the alkyl group can include a hydrogen atom that can be optionally replaced with a fluorine atom);

E and G are independently a linear or branched alkyl group having 1 to 20 carbon atoms of which the alkyl group can include a hydrogen atom that can be optionally replaced with a fluorine atom, or an aromatic group capable of having a substituent (that

is a halogen atom, a cyano atom, a nitro atom, a trialkylsilyl group of which the alkyl groups are independently a linear or branched alkyl group having 1 - 8 carbon atoms, a linear or branched alkyl group having 1 to 20 carbon atoms of which the alkyl group can include one or non-neighboring two or more methylene groups that can be replaced with -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH- or -C≡C-, and the alkyl group can include a hydrogen atom that can be optionally replaced with a fluorine atom; and

at least one of the optional substituent(s) of the cyclic groups, and the cyclic groups CyC1 and CyC2 include an aromatic group capable of having a substituent represented by the following formula (5):

15



(5)

wherein the aromatic group of the formula (5) is bonded to CyN1, CyN2, CyC1 or CyC2 via a single bond when the aromatic group is the optional substituent(s) of the cyclic groups, and the aromatic group of the formula (5) is bonded to CyN1 or CyN2 via a single bond and bonded to the metal atom M via a single bond when the aromatic group is CyC1 or CyC2;

25

Y denotes C=O, CRR', C=C(CN)₂, O or S wherein R and R' are independently a hydrogen atom, a linear or branched alkyl group having 1 to 8 carbon atoms, a

linear or branched alkyl group having 1 to 20 carbon atoms of which the alkyl group can include one or non-neighboring two or more methylene groups that can be replaced with -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH- or -C≡C-, and the alkyl group can include a hydrogen atom that can be optionally replaced with a fluorine atom, or an aromatic group capable of having a substituent (that is a halogen atom, a cyano atom, a nitro atom, a trialkylsilyl group of which the alkyl groups are independently a linear or branched alkyl group having 1 - 8 carbon atoms, a linear or branched alkyl group having 1 to 20 carbon atoms of which the alkyl group can include one or non-neighboring two or more methylene groups that can be replaced with -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH- or -C≡C-, and the alkyl group can include a hydrogen atom that can be optionally replaced with a fluorine atom); and

the optional substituent of the aromatic group of the formula (5) is selected from a halogen atom, cyano group, a nitro group, a trialkylsilyl group of which the alkyl groups are independently a linear or branched alkyl group having 1 to 8 carbon atoms, a linear or branched alkyl group having 1 to 20 carbon atoms of which the alkyl group can include one or non-neighboring two or more methylene groups that can be replaced with -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH- or -C≡C-, and the alkyl group can include a

hydrogen atom that can be optionally replaced with a
fluorine atom, or an aromatic group capable of having
a substituent (that is a halogen atom, a cyano atom, a
nitro atom, a linear or branched alkyl group having 1
5 to 20 carbon atoms of which the alkyl group can
include one or non-neighboring two or more methylene
groups that can be replaced with -O-, -S-, -CO-, -CO-
O-, -O-CO-, -CH=CH- or -C≡C-, and the alkyl group can
include a hydrogen atom that can be optionally
10 replaced with a fluorine atom) with the proviso that
an adjacent pair of substituents can be bonded to form
a cyclic structure.

Preferred embodiments of the metal
coordination compound of the formula (1) according to
15 the present invention include the following:

A metal coordination compound having a
partial structure ML'_n represented by the formula (3)
in the formula (1).

A metal coordination compound having a
20 partial structure ML'_n represented by the formula (4)
in the formula (1).

A metal coordination compound, wherein n is 0
in the formula (1).

A metal coordination compound, wherein the
25 group Y in the formula (5) is
C=O or CRR'.

A metal coordination compound wherein the

cyclic groups CyC1 in the formula (1) and CyC2 in the formula (3) are independently selected from phenyl group, thienyl group, thianaphthyl group, naphthyl group, pyrenyl group, 9-fluorenonyl group, fluorenyl group, dibenzofuryl group, dibenzothienyl group, or carbazolyl group, as an aromatic cyclic group capable of having a substituent with the proviso that the aromatic cyclic group can include one or two CH groups that can be replaced with a nitrogen atom, particularly selected from phenyl group or 2-fluorenyl group.

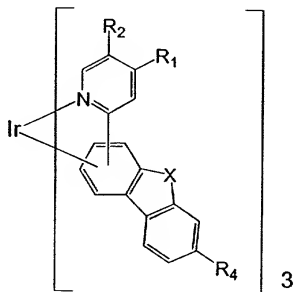
A metal coordination compound, wherein the cyclic groups CyN1 in the formula (2) and CyN2 in the formula (3) are independently selected from pyridyl group, pyridazinyl group, and pyrimidinyl group, particularly pyridyl group, as an aromatic cyclic group capable of having a substituent.

A metal coordination compound, wherein the cyclic groups CyN1, CyN2, CyC1 and CyC2 are independently non-substituted, or have a substituent selected from a halogen atom and a linear or branched alkyl group having 1 to 20 carbon atoms {of which the alkyl group can include one or non-neighboring two or more methylene groups that can be replaced with -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH-, -C≡C-, or a divalent aromatic group capable of having a substituent (that is a halogen atom or a linear or

branched alkyl group having 1 to 20 carbon atoms (of which the alkyl group can include one or non-neighboring two or more methylene groups that can be replaced with -O-, and the alkyl group can include a hydrogen atom that can be optionally replaced with a fluorine atom)), and the alkyl group can include a hydrogen atom that can be optionally replaced with a fluorine atom}.

A metal coordination compound, wherein M in the formula (1) is iridium.

A metal coordination compound represented by the following formula (6):



(6)

wherein X denotes CRR', O or S where R and R' are independently a linear or branched alkyl group of formula: C_nH_{2n+1} in which n is an integer of 1 - 20, the alkyl group can include one or non-neighboring two or more methylene groups that can be replaced with -O- and also can include a hydrogen atom that can be optionally replaced with a fluorine atom;

R2 denotes a hydrogen atom; a fluorine atom;
a linear or branched alkyl group of formula: $C_nH_{2n+1}-$
in which n is an integer of 1 - 20, the alkyl group
can include one or non-neighboring two or more

- 5 methylene groups that can be replaced with -O- and
also can include a hydrogen atom that can be
optionally replaced with a fluorine atom; a phenyl
group capable of having a substituent; a 9,9-
dialkylfluorenyl group (of which the alkyl groups are
10 independently a linear or branched alkyl group of
formula: $C_nH_{2n+1}-$ in which n is an integer of 1 - 20,
the alkyl group can include one or non-neighboring two
or more methylene groups that can be replaced with -O-
and also can include a hydrogen atom that can be
15 optionally replaced with a fluorine atom); a
dibenzofuranyl group capable of having a substituent;
and a dibenzothienyl group capable of having a
substituent; the optional substituent of phenyl group,
9,9-dialkylfluorenyl group, dibenzofuranyl group and
20 dibenzothienyl group is a fluorine atom or a linear or
branched alkyl group of formula: $C_nH_{2n+1}-$ in which n
is an integer of 1 - 20, the alkyl group can include
one or non-neighboring two or more methylene groups
that can be replaced with -O- and also can include a
25 hydrogen atom that can be optionally replaced with a
fluorine atom.

The present invention also provides an

electroluminescence device, comprising: a pair of electrodes disposed on a substrate, and a luminescence unit comprising at least one organic compound disposed between the electrodes, wherein the organic compound
5 comprises a metal coordination compound represented by the formula (1) described above.

In the luminescence device, a voltage is applied between the electrodes to emit light.

In a preferred embodiment of the
10 electroluminescence device, a voltage is applied between the electrodes to emit phosphorescence.

The present invention further provides a picture display apparatus, comprising an electroluminescence device described above and a means
15 for supplying electric signals to the electroluminescence device.

These and other objects, features and advantages of the present invention will become more apparent upon a consideration of the following
20 description of the preferred embodiments of the present invention taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

25 Figures 1A, 1B and 1C illustrate embodiments of the luminescence device according to the present invention, respectively.

Figure 2 schematically illustrates a panel structure including an EL device and drive means.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

5 Basic structures of organic luminescence (EL) devices formed according to the present invention are illustrated in Figures 1A, 1B and 1C.

As shown in these figures, an organic luminescence device generally comprises, on a
10 transparent substrate 15, a 50 to 200 nm-thick transparent electrode 14, a plurality of organic film layers and a metal electrode 11 formed so as to cover the organic layers.

Figure 1A shows an embodiment wherein the
15 organic luminescence device comprises a luminescence layer 12 and a hole-transporting layer 13. The transparent electrode 14 may comprise ITO, etc., having a large work function so as to facilitate hole injection from the transparent electrode 14 to the
20 hole-transporting layer 13. The metal electrode 11 comprises a metal material having a small work function, such as aluminum, magnesium or alloys of these elements, so as to facilitate electron injection into the organic luminescence device.

25 The luminescence layer 12 comprises a compound (metal coordination compound) according to the present invention. The hole-transporting layer 13

may comprise, e.g., a triphenyldiamine derivative, as represented by α -NPD mentioned above, and also a material having an electron-donative property as desired.

5 A device organized above exhibits a current-rectifying characteristic, and when an electric field is applied between the metal electrode 11 as a cathode and the transparent electrode 14 as an anode, electrons are injected from the metal electrode 11
10 into the luminescence layer 12, and holes are injected from the transparent electrode 15. The injected holes and electrons are recombined in the luminescence layer 12 to form excitons having high energy potential, which cause luminescence during transition to the
15 ground state. In this instance, the hole-transporting layer 13 functions as an electron-blocking layer to increase the recombination efficiency at the boundary between the luminescence layer layer 12 and the hole-transporting layer 13, thereby providing an enhanced
20 luminescence efficiency.

Further, in the structure of Figure 1B, an electron-transporting layer 16 is disposed between the metal electrode 11 and the luminescence layer 12 in Figure 1A. As a result, the luminescence function is
25 separated from the functions of electron transportation and hole transportation to provide a structure exhibiting more effective carrier blocking,

thus increasing the luminescence efficiency. The electron-transporting layer 16, may comprise, e.g., an oxadiazole derivative.

Figure 1C shows another desirable form of a four-layer structure, including a hole-transporting layer 13, a luminescence layer 12, an exciton diffusion prevention layer 17 and an electron-transporting layer 16, successively from the side of the transparent electrode 14 as the anode.

The luminescence materials used in the present invention are most suitably metal coordination compounds represented by the above-mentioned formulae (1) to (5), which are found to cause high-efficiency luminescence, retain high luminance for a long period and show little deterioration by current passage.

The metal coordination compound of the present invention emits phosphorescence, and its lowest excited state is believed to be an MLCT* (metal-to-ligand charge transfer) excited state or π - π^* excited state in a triplet state, and phosphorescence is caused at the time of transition from such a state to the ground state.

Hereinbelow, methods for measurement of some properties and physical values described herein for characterizing the luminescence material of the present invention will be described.

(1) Judgment between phosphorescence and

fluorescence

The identification of phosphorescence was effected depending on whether deactivation with oxygen was caused or not. A solution of a sample compound in chloroform after aeration with oxygen or with nitrogen is subjected to photoillumination to cause photoluminescence. The luminescence is judged to be phosphorescence if almost no luminescence attributable to the compound is observed with respect to the solution aerated with oxygen but photoluminescence is confirmed with respect to the solution aerated with nitrogen. The phosphorescence of all the compounds of the present invention has been confirmed by this method unless otherwise noted specifically.

(2) Phosphorescence yield (a relative quantum yield, i.e., a ratio of an objective sample's quantum yield $\Phi(\text{sample})$ to a standard sample's quantum yield $\Phi(\text{st})$) is determined according to the following formula:

$$\Phi(\text{sample})/\Phi(\text{st}) = \frac{[\text{Sem}(\text{sample})/\text{Iabs}(\text{sample})]}{[\text{Sem}(\text{st})/\text{Iabs}(\text{st})]},$$
wherein $\text{Iabs}(\text{st})$ denotes an absorption coefficient at an excitation wavelength of the standard sample; $\text{Sem}(\text{st})$, a luminescence spectral areal intensity when excited at the same wavelength; $\text{Iabs}(\text{sample})$, an absorption coefficient at an excitation wavelength of an objective compound; and $\text{Sem}(\text{sample})$, a luminescence

spectral areal intensity when excited at the same wavelength.

Phosphorescence yield values described herein are relative values with respect to a phosphorescence yield $\Phi = 1$ of Ir(ppy)_3 as a standard sample.

(3) A method of measurement of phosphorescence life is as follows.

A sample compound is dissolved in chloroform and spin-coated onto a quartz substrate in a thickness of ca. 0.1 μm and is exposed to pulsative nitrogen laser light at an excitation wavelength of 337 nm at room temperature by using a luminescence life meter (made by Hamamatsu Photonics K.K.). After completion of the excitation pulses, the decay characteristic of luminescence intensity is measured.

When an initial luminescence intensity is denoted by I_0 , a luminescence intensity after $t(\text{sec})$ is expressed according to the following formula with reference to a luminescence life $\tau(\text{sec})$:

$$I = I_0 \cdot \exp(-t/\tau).$$

The luminescence material (metal coordination compound) of the present invention exhibited high phosphorescence quantum yields of 0.11 to 0.9 and short phosphorescence lives of 0.1 to 40 μsec . A short phosphorescence life becomes a condition for causing little energy deactivation and exhibiting an enhanced luminescence efficiency. More specifically

if the phosphorescence life is long, the number of triplet state molecules maintained for luminescence is increased, and the deactivation process is liable to occur, thus resulting in a lower luminescence

5 efficiency particularly at the time of a high-current density. The material of the present invention has a relatively short phosphorescence life thus exhibiting a high phosphorescence quantum yield, and is therefore suitable as a luminescence material for an EL device.

10 As a result of various studies of ours, it has been found that an organic EL device using the metal coordination compound of the formula (1) as a principal luminescence material causes high-efficiency luminescence, retains high luminance for a long
15 period and shows little deterioration by current passage.

In the formula (1) representing the metal coordination compound of the present invention, n may preferably 0 or 1, more preferably 0. Further, the
20 partial structure ML'n may preferably comprise the aromatic group represented by the above-mentioned formula (5). In the formula (5), Y may preferably comprise C=O or CRR'. When Y is CRR' where R and R' are CH₃, the metal coordination compound of the
25 formula (1) may preferably have no substituent. Particularly, when CyC1 is FL2 (appearing hereinafter) where R and R' are CH₃ and CyN1 is Pi, R1 to R4 (as

substituents for Pi and FL2) may preferably be hydrogen atom at the same time.

In the present invention, by incorporating the aromatic group of the formula (5) into the metal coordination compound of the formula (1), it becomes possible to control an emission wavelength (particularly to provide a long emission wavelength). The presence of the aromatic group of the formula (5) is effective in enhancing a solubility of the metal coordination compound of the present invention in an organic solvent, thus facilitating a purification thereof by recrystallization or column chromatography. As a result, the metal coordination compound of the present invention is suitable as a luminescence material for the organic EL device.

Further, as shown in Examples appearing hereinafter, it has been substantiated that the metal coordination compound of the present invention exhibited an excellent stability in a continuous current passage test. This may be attributable to incorporation of the aromatic group of the formula (5) into the molecular structure of the metal coordination compound of the formula (1) according to the present invention. More specifically, a change in intermolecular interaction due to the introduction of the aromatic group of the formula (5) allows an intermolecular interaction of the metal coordination

compound with, e.g., a host material to suppress formation of exciton associates causing thermal deactivation, thus reducing a quenching process thereby to improve phosphorescence yield and device characteristics.

The luminescence device according to the present invention may preferably be an electroluminescence device of the type wherein a layer of the metal coordination compound of the formula (1) is disposed between opposing two electrodes and a voltage is applied between the electrodes to cause luminescence, as shown in Figures 1A, 1B and 1C.

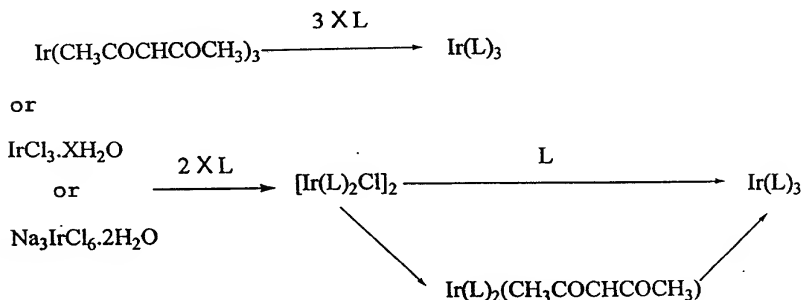
For the application to a display, a drive system using a thin-film transistor (TFT) drive circuit according to an active matrix-scheme may be used. Hereinbelow, an embodiment of using a device of the present invention in combination with an active matrix substrate is briefly described with reference to Figure 2.

Figure 2 illustrates an embodiment of panel structure comprising an EL device and drive means. The panel is provided with a scanning signal driver, a data signal driver and a current supply source which are connected to gate selection lines, data signal lines and current supply lines, respectively. At each intersection of the gate selection lines and the data signal lines, a display pixel electrode is disposed.

The scanning signal drive sequentially selects the gate selection lines G1, G2, G3 ... Gn, and in synchronism herewith, picture signals are supplied from the data signal driver to display a picture (image).

By driving a display panel including a luminescence layer comprising a luminescence material of the present invention, it becomes possible to provide a display which exhibits a good picture quality and is stable even for a long period display.

Some synthetic paths for providing a metal coordination compound represented by the above-mentioned formula (1) are illustrated below with reference to an iridium coordination compound (m+n = 3) for example:

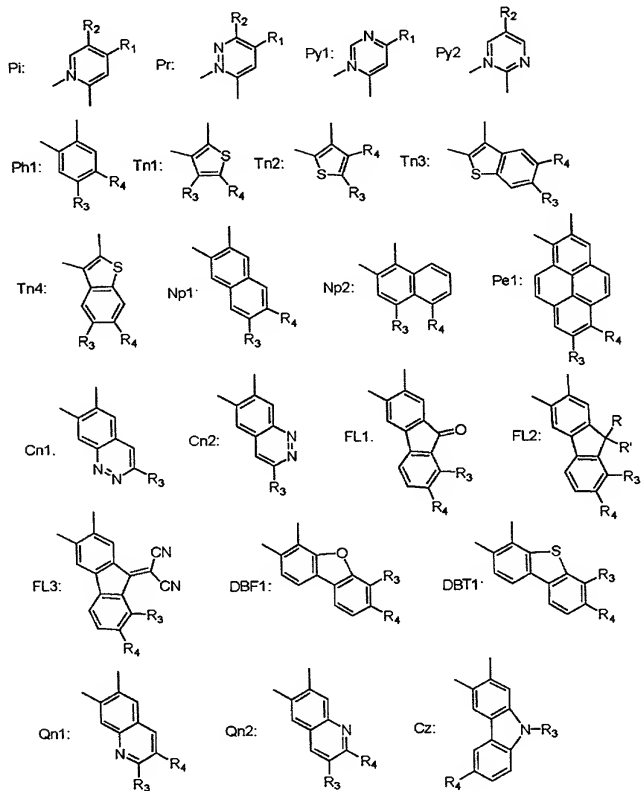


Other metal coordination compound (M = Pt, Rh and Pd) can also be synthesized in a similar manner.

Some specific structural examples of metal coordination compounds used in the present invention

are shown in Tables 1 to Tables 42 appearing hereinafter, which are however only representative examples and are not exhaustive. Pi to Cz for CyN1, CyN2, CyC1 and CyC2 shown in Tables 1 to 42 represent partial structures shown below.

10
15
20
25



Further, aromatic group Ph2 to DBT3 as
substituents for CyN1, CyN2, CyC1 and CyC2 shown in
Tables 1 to 42 represent partial structures shown
below, with the proviso that substituents R5 to R8 of
5 the aromatic groups represent hydrogen atoms when they
are not specifically indicated.

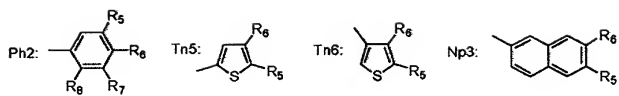
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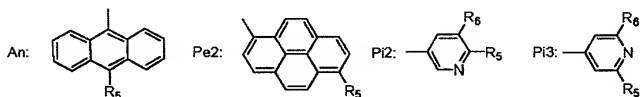
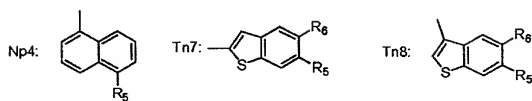
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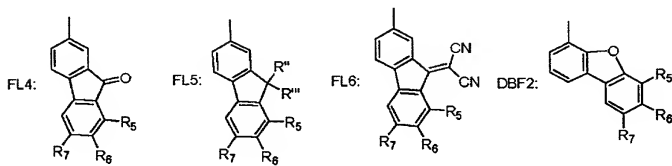
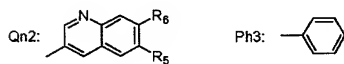
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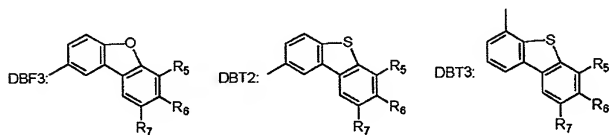
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No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
R''	R'''	CyC1-R3	CyC1-R4	CyC1									
R5	R6	R7	R8										
1	Ir	3	0	Pi	FL1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
2	Ir	3	0	Pi	FL1	-	-	H	CF ₃	-	-	-	-
						-	-	H	H	-	-	-	-
3	Ir	3	0	Pi	FL1	-	-	CF ₃	CF ₃	-	-	-	-
						-	-	H	H	-	-	-	-
4	Ir	3	0	Pi	FL1	-	-	H	CH ₃	-	H	-	-
						-	-	H	H	-	-	-	-
5	Ir	3	0	Pi	FL1	-	-	H	H	-	-	-	-
						-	-	H	OC ₄ H ₉	-	-	-	-
6	Ir	3	0	Pi	FL1	-	-	H	FL4	H	H	H	-
						-	-	H	H	-	-	-	-
7	Ir	3	0	Pi	FL1	-	-	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
8	Ir	3	0	Pi	FL1	-	-	H	FL6	H	H	H	-
						-	-	H	H	-	-	-	-
9	Ir	3	0	Pi	FL1	-	-	H	DBF2	H	H	H	-
						-	-	H	H	-	-	-	-
10	Ir	3	0	Pi	FL1	-	-	H	DBT3	H	H	H	-
						-	-	H	H	-	-	-	-
11	Ir	3	0	Pi	FL1	-	-	H	Ph2	H	H	H	H
						-	-	H	H	-	-	-	-
12	Ir	3	0	Pi	FL1	-	-	H	Ph2	H	C ₃ H ₇	H	H
						-	-	H	H	-	-	-	-
13	Ir	3	0	Pi	FL1	-	-	H	FL4	H	Ph3	H	-
						-	-	H	Ph2	H	H	H	H
14	Ir	3	0	Pi	FL1	-	-	H	Np4	H	-	-	-
						-	-	H	H	-	-	-	-
15	Ir	3	0	Pi	FL1	-	-	H	Tn7	H	H	-	-
						-	-	H	H	-	-	-	-
16	Ir	3	0	Pi	Ph1	-	-	H	FL4	H	H	H	-
						-	-	H	H	-	-	-	-

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R''	R'''	CyC1-R3	CyC1-R4	CyC1			
						R5	R6	R7	R8				
1	Ir	3	0	Pi	FL1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
2	Ir	3	0	Pi	FL1	-	-	H	CF ₃	-	-	-	-
						-	-	H	H	-	-	-	-
3	Ir	3	0	Pi	FL1	-	-	CF ₃	CF ₃	-	-	-	-
						-	-	H	H	-	-	-	-
4	Ir	3	0	Pi	FL1	-	-	H	CH ₃	-	H	-	-
						-	-	H	H	-	-	-	-
5	Ir	3	0	Pi	FL1	-	-	H	H	-	-	-	-
						-	-	H	OC ₄ H ₉	-	-	-	-
6	Ir	3	0	Pi	FL1	-	-	H	FL4	H	H	H	-
						-	-	H	H	-	-	-	-
7	Ir	3	0	Pi	FL1	-	-	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
8	Ir	3	0	Pi	FL1	-	-	H	FL6	H	H	H	-
						-	-	H	H	-	-	-	-
9	Ir	3	0	Pi	FL1	-	-	H	DBF2	H	H	H	-
						-	-	H	H	-	-	-	-
10	Ir	3	0	Pi	FL1	-	-	H	DBT3	H	H	H	-
						-	-	H	H	-	-	-	-
11	Ir	3	0	Pi	FL1	-	-	H	Ph2	H	H	H	H
						-	-	H	H	-	-	-	-
12	Ir	3	0	Pi	FL1	-	-	H	Ph2	H	C ₃ H ₇	H	H
						-	-	H	H	-	-	-	-
13	Ir	3	0	Pi	FL1	-	-	H	FL4	H	Ph3	H	-
						-	-	H	Ph2	H	H	H	H
14	Ir	3	0	Pi	FL1	-	-	H	Np4	H	-	-	-
						-	-	H	H	-	-	-	-
15	Ir	3	0	Pi	FL1	-	-	H	Tn7	H	H	-	-
						-	-	H	H	-	-	-	-
16	Ir	3	0	Pi	Ph1	-	-	H	FL4	H	H	H	-
						-	-	H	H	-	-	-	-

Table 2

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
						R''	R'''	CyC1-R3	CyC1-R4	R5	R6	R7	R8
										CyC1			
										R5	R6	R7	R8
										R5	R6	R7	R8
17	Ir	3	0	Pi	Np2	-	-	H	FL4	H	H	H	-
						-	-	H	H	-	-	-	-
18	Ir	3	0	Pi	FL1	-	-	H	Ph2	H	FL4	H	H
						-	-	H	H	-	-	-	-
19	Ir	3	0	Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	FL4	H	H	H	H	-
20	Ir	3	0	Pi	Ph1	-	-	H	H	-	-	-	-
						C ₂ H ₅	C ₂ H ₅	FL5	H	H	H	H	-
21	Ir	3	0	Pi	Ph1	-	-	H	Ph2	H	FL4	H	H
						-	-	H	H	-	-	-	-
22	Ir	3	0	Pi	Np2	-	-	H	Ph2	H	FL4	H	H
						-	-	H	H	-	-	-	-
23	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
24	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	CF ₃	-	-	-	-
						-	-	H	H	-	-	-	-
25	Ir	3	0	Pi	FL2	CH ₃	CH ₃	CF ₃	CF ₃	-	-	-	-
						-	-	H	H	-	-	-	-
26	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	CH ₃	-	-	-	-
						-	-	H	H	-	-	-	-
27	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	H	-	-	-	-
						-	-	H	OC ₄ H ₉	-	-	-	-
28	Ir	3	0	Pi	FL2	C ₂ H ₅	C ₂ H ₅	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
29	Ir	3	0	Pi	FL2	C ₃ H ₇	C ₃ H ₇	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
30	Ir	3	0	Pi	FL2	C ₄ H ₉	C ₄ H ₉	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
31	Ir	3	0	Pi	FL2	C ₅ H ₁₁	C ₅ H ₁₁	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
32	Ir	3	0	Pi	FL2	C ₆ H ₁₃	C ₆ H ₁₃	H	H	-	-	-	-
						-	-	H	H	-	-	-	-

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Table 3

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
						R"	R'''	CyC1-R3	CyC1-R4	R5	R6	R7	R8
										CyC1			
										R5	R6	R7	R8
33	Ir	3	0	Pi	FL2	C ₇ H ₁₅	C ₇ H ₁₅	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
34	Ir	3	0	Pi	FL2	C ₈ H ₁₇	C ₈ H ₁₇	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
35	Ir	3	0	Pi	FL2	C ₁₀ H ₂₁	C ₁₀ H ₂₁	H	CF ₃	-	-	-	-
						-	-	H	H	-	-	-	-
36	Ir	3	0	Pi	FL2	C ₁₅ H ₃₁	C ₁₅ H ₃₁	H	H	-	-	-	-
						-	-	H	OC ₄ H ₉	-	-	-	-
37	Ir	3	0	Pi	FL2	C ₂₀ H ₄₁	C ₂₀ H ₄₁	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
38	Ir	3	0	Pi	FL2	Ph3	Ph3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
39	Ir	3	0	Pi	FL2	CH ₃	Ph3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
40	Ir	3	0	Pi	FL2	(CH ₂) ₅ Ph3	(CH ₂) ₅ Ph3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
41	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	FL4	H	H	H	-
						-	-	H	H	-	-	-	-
42	Ir	3	0	Pi	FL2	H	H	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
43	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
44	Ir	3	0	Pi	FL2	C ₂ H ₅	C ₂ H ₅	H	FL5	H	H	H	-
						C ₂ H ₅	C ₂ H ₅	H	H	-	-	-	-
45	Ir	3	0	Pi	FL2	C ₈ H ₁₁	C ₉ H ₁₁	H	FL5	H	H	H	-
						C ₈ H ₁₁	C ₉ H ₁₁	H	H	-	-	-	-
46	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	FL5	H	H	H	-
						C ₈ H ₁₇	C ₈ H ₁₇	H	H	-	-	-	-
47	Ir	3	0	Pi	FL2	C ₁₅ H ₃₁	C ₁₅ H ₃₁	H	FL5	H	H	H	-
						C ₁₅ H ₃₁	C ₁₅ H ₃₁	H	H	-	-	-	-
48	Ir	3	0	Pi	FL2	Ph3	Ph3	H	FL5	H	H	H	-
						Ph3	Ph3	H	H	-	-	-	-

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Table 4

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
						R''	R'''	CyC1-R3	CyC1-R4	R5	R6	R7	R8
										CyC1			
										R5	R6	R7	R8
49	Ir	3	0	Pi	FL2	CH ₃	Ph3	H	FL5	H	H	H	-
						CH ₃	Ph3	H	H	-	-	-	-
50	Ir	3	0	Pi	FL2	(CH ₂) ₅ Ph3	(CH ₂) ₅ Ph3	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
51	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	FL6	H	H	H	-
						-	-	H	H	-	-	-	-
52	Ir	3	0	Pi	FL2	C ₂ H ₅	C ₂ H ₅	H	DBF2	H	H	H	-
						-	-	H	H	-	-	-	-
53	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	DBT3	H	H	H	-
						-	-	H	H	-	-	-	-
54	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	H	H	H
						-	-	H	H	-	-	-	-
55	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	Ph2	CF ₃	H	H	H
						-	-	H	H	-	-	-	-
56	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	OCH ₂ C ₅ F ₁₁	H	H
						-	-	H	H	-	-	-	-
57	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	OC≡C-C ₇ H ₁₅	H	H
						-	-	H	H	-	-	-	-
58	Ir	3	0	Pi	FL2	C ₃ H ₇	C ₃ H ₇	H	Tn5	H	H	-	-
						-	-	H	H	-	-	-	-
59	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	Tn6	H	H	-	-
						-	-	H	H	-	-	-	-
60	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	Np3	H	H	-	-
						-	-	H	H	-	-	-	-
61	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	Np4	H	-	-	-
						-	-	H	H	-	-	-	-
62	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	Tn7	H	H	-	-
						-	-	H	H	-	-	-	-
63	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	Tn8	H	H	-	-
						-	-	H	H	-	-	-	-
64	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	An	H	-	-	-
						-	-	H	H	-	-	-	-

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
										CyC1			
						R''	R'''	CyC1-R3	CyC1-R4	R5	R6	R7	R8
65	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	Pe2	H	-	-	-
						-	-	H	H	-	-	-	-
66	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	Pi2	H	H	-	-
						-	-	H	H	-	-	-	-
67	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	Pi3	H	H	-	-
						-	-	H	H	-	-	-	-
68	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	Qn2	H	H	-	-
						-	-	H	H	-	-	-	-
69	Ir	3	0	Pi	FL2	Ph3	Ph3	H	Np4	H	-	-	-
						-	-	H	H	-	-	-	-
70	Ir	3	0	Pi	FL2	CH ₃	Ph3	H	An	H	-	-	-
						-	-	H	H	-	-	-	-
71	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	FL4	H	Ph3	H	-
						-	-	H	Ph2	H	H	H	H
72	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	FL5	H	Ph3	H	-
						CH ₃	CH ₃	H	Ph2	H	H	H	H
73	Ir	3	0	Pi	FL2	Ph3	Ph3	H	FL5	H	Ph3	H	-
						Ph3	Ph3	H	Ph2	H	H	H	H
74	Ir	3	0	Pi	FL2	CH ₃	Ph3	H	FL5	H	Ph3	H	-
						CH ₃	Ph3	H	Ph2	H	H	H	H
75	Ir	3	0	Pi	FL2	CH ₃	Ph3	H	FL5	H	Ph3	H	-
						CH ₃	Ph3	H	Ph2	H	H	H	H
76	Ir	3	0	Pi	FL2	(CH ₂) ₃ Ph3	(CH ₂) ₃ Ph3	H	FL5	H	Ph3	H	-
						CH ₃	CH ₃	H	Ph2	H	H	H	H
77	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	FL5	H	Ph3	H	-
						CH ₃	CH ₃	H	Tn5	C ₃ H ₇	H	-	-
78	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	FL5	H	Ph3	H	-
						CH ₃	CH ₃	H	Tn6	H	H	-	-
79	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	FL5	H	Ph3	H	-
						CH ₃	CH ₃	H	Np3	H	H	-	-
80	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	FL5	H	Ph3	H	-
						CH ₃	CH ₃	H	Np4	H	-	-	-

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
										CyC1			
						R''	R'''	CyC1-R3	CyC1-R4	R5	R6	R7	R8
65	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	Pe2	H	-	-	-
						-	-	H	H	-	-	-	-
66	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	Pi2	H	H	-	-
						-	-	H	H	-	-	-	-
67	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	Pi3	H	H	-	-
						-	-	H	H	-	-	-	-
68	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	Qn2	H	H	-	-
						-	-	H	H	-	-	-	-
69	Ir	3	0	Pi	FL2	Ph3	Ph3	H	Np4	H	-	-	-
						-	-	H	H	-	-	-	-
70	Ir	3	0	Pi	FL2	CH ₃	Ph3	H	An	H	-	-	-
						-	-	H	H	-	-	-	-
71	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	FL4	H	Ph3	H	-
						-	-	H	Ph2	H	H	H	H
72	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	FL5	H	Ph3	H	-
						CH ₃	CH ₃	H	Ph2	H	H	H	H
73	Ir	3	0	Pi	FL2	Ph3	Ph3	H	FL5	H	Ph3	H	-
						Ph3	Ph3	H	Ph2	H	H	H	H
74	Ir	3	0	Pi	FL2	CH ₃	Ph3	H	FL5	H	Ph3	H	-
						CH ₃	Ph3	H	Ph2	H	H	H	H
75	Ir	3	0	Pi	FL2	CH ₃	Ph3	H	FL5	H	Ph3	H	-
						CH ₃	Ph3	H	Ph2	H	H	H	H
76	Ir	3	0	Pi	FL2	(CH ₂) ₃ Ph3	(CH ₂) ₃ Ph3	H	FL5	H	Ph3	H	-
						CH ₃	CH ₃	H	Ph2	H	H	H	H
77	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	FL5	H	Ph3	H	-
						CH ₃	CH ₃	H	Tn5	C ₃ H ₇	H	-	-
78	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	FL5	H	Ph3	H	-
						CH ₃	CH ₃	H	Tn6	H	H	-	-
79	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	FL5	H	Ph3	H	-
						CH ₃	CH ₃	H	Np3	H	H	-	-
80	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	FL5	H	Ph3	H	-
						CH ₃	CH ₃	H	Np4	H	-	-	-

[illegible]

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1											
										R5	R6	R7	R8								
														R''	R'''	CyC1-R3	CyC1-R4	CyC1			
																		R5	R6	R7	R8
81	Ir	3	0	Pi	FL2	CH ₃	Ph3	H	FL5	H	Ph3	H	-								
						CH ₃	Ph3	H	Tn7	H	H	-	-								
82	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	FL5	H	Ph3	H	-								
						CH ₃	CH ₃	H	Tn8	H	H	-	-								
83	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	FL5	H	Ph3	H	-								
						CH ₃	CH ₃	H	An	H	-	-	-								
84	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	FL5	H	Ph3	H	-								
						CH ₃	CH ₃	H	Pe2	H	-	-	-								
85	Ir	3	0	Pi	FL2	CH ₃	Ph3	H	FL5	H	Ph3	H	-								
						CH ₃	Ph3	H	Pi2	C ₂ H ₅	H	-	-	-							
86	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	FL5	H	Ph3	H	-								
						CH ₃	CH ₃	H	Pi3	H	H	-	-								
87	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	FL5	H	Ph3	H	-								
						CH ₃	CH ₃	H	Qn2	H	H	-	-								
88	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	FL5	H	Ph3	H	-								
						CH ₃	CH ₃	H	DBT3	H	H	-	-								
89	Ir	3	0	Pi	Ph1	-	-	H	FL5	H	H	H	-								
						CH ₃	CH ₃	H	H	-	-	-	-								
90	Ir	3	0	Pi	Ph1	-	-	H	FL5	H	H	H	-								
						C ₅ H ₁₁	C ₅ H ₁₁	H	H	-	-	-	-								
91	Ir	3	0	Pi	Ph1	-	-	H	FL5	H	H	H	-								
						CH ₃	CH ₃	H	CF3	-	-	-	-								
92	Ir	3	0	Pi	Ph1	-	-	H	FL5	H	H	H	-								
						Ph3	Ph3	H	H	-	-	-	-								
93	Ir	3	0	Pi	Ph1	-	-	H	FL5	H	H	H	-								
						CH ₃	Ph3	H	H	-	-	-	-								
94	Ir	3	0	Pi	Tn1	-	-	H	FL5	H	H	H	-								
						CH ₃	CH ₃	H	H	-	-	-	-								
95	Ir	3	0	Pi	Tn2	-	-	H	FL5	H	H	H	-								
						CH ₃	CH ₃	H	H	-	-	-	-								
96	Ir	3	0	Pi	Tn3	-	-	H	FL5	H	H	H	-								
						CH ₃	CH ₃	H	H	-	-	-	-								

THE

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R''	R'''	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
97	Ir	3	0	Pi	Tn4	-	-	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
98	Ir	3	0	Pi	Np1	-	-	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
99	Ir	3	0	Pi	Np2	-	-	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
100	Ir	3	0	Pi	Pe1	-	-	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
101	Ir	3	0	Pi	Np2	-	-	H	FL5	H	H	H	-
						Ph3	Ph3	H	H	-	-	-	-
102	Ir	3	0	Pi	Pe2	-	-	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
103	Ir	3	0	Pi	Cn1	-	-	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	-	-	-	-	-
104	Ir	3	0	Pi	Cn2	-	-	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	-	-	-	-	-
105	Ir	3	0	Pi	FL3	-	-	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
106	Ir	3	0	Pi	DBF1	-	-	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
107	Ir	3	0	Pi	DBT1	-	-	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
108	Ir	3	0	Pi	Qn1	-	-	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
109	Ir	3	0	Pi	Qn2	-	-	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
110	Ir	3	0	Pi	Cz	-	-	H	FL5	H	H	H	-
						CH ₃	CH ₃	Ph3	H	-	-	-	-
111	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	FL5	H	H
						CH ₃	CH ₃	H	H	-	-	-	-
112	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	Tn5	FL5	H	-	-
						CH ₃	CH ₃	H	H	-	-	-	-

Table 8

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
						R''	R'''	CyC1-R3	CyC1-R4	R5	R6	R7	R8
										CyC1			
113	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	Tn6	FL5	H	-	-
						CH ₃	CH ₃	H	H	-	-	-	-
114	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	Np3	FL5	H	-	-
						CH ₃	CH ₃	H	H	-	-	-	-
115	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	Np4	FL5	-	-	-
						CH ₃	CH ₃	H	H	-	-	-	-
116	Ir	3	0	Pi	FL2	Ph3	Ph3	H	Tn7	FL5	H	-	-
						Ph3	Ph3	H	H	-	-	-	-
117	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	Tn8	FL5	H	-	-
						Ph3	Ph3	H	H	-	-	-	-
118	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	An	FL5	-	-	-
						CH ₃	CH ₃	H	H	-	-	-	-
119	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	Pe2	FL5	-	-	-
						CH ₃	CH ₃	H	H	-	-	-	-
120	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	Qn2	FL5	H	-	-
						CH ₃	CH ₃	H	H	-	-	-	-
121	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	FL4	FL5	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
122	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	FL5	FL5	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
123	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	FL6	FL5	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
124	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	DBF2	FL5	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
125	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	DBF3	FL5	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
126	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	DBT2	FL5	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
127	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	DBT3	FL5	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
128	Ir	3	0	Pi	Ph1	-	-	H	H	-	-	-	-
						C ₈ H ₁₇	C ₈ H ₁₇	FL5	H	H	H	H	-

[illegible]

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
R''	R'''	CyC1-R3	CyC1-R4	CyC1									
R5	R6	R7	R8										
129	Ir	3	0	Pi	Tn1	-	-	H	H	-	-	-	-
						CH ₃	CH ₃	FL5	H	H	H	H	-
130	Ir	3	0	Pi	Tn2	-	-	H	H	-	-	-	-
						CH ₃	CH ₃	FL5	H	H	H	H	-
131	Ir	3	0	Pi	Tn3	-	-	H	H	-	-	-	-
						CH ₃	CH ₃	FL5	H	H	H	H	-
132	Ir	3	0	Pi	Tn4	-	-	H	H	-	-	-	-
						CH ₃	CH ₃	FL5	H	H	H	H	-
133	Ir	3	0	Pi	Np2	-	-	H	H	-	-	-	-
						CH ₃	CH ₃	FL5	H	H	H	H	-
134	Ir	3	0	Pi	Pe1	-	-	H	H	-	-	-	-
						CH ₃	CH ₃	FL5	H	H	H	H	-
135	Ir	3	0	Pi	Cn1	-	-	H	H	-	-	-	-
						CH ₃	CH ₃	FL5	-	H	H	H	-
136	Ir	3	0	Pi	Cn2	-	-	H	H	-	-	-	-
						CH ₃	CH ₃	FL5	-	H	H	H	-
137	Ir	3	0	Pi	FL3	-	-	H	H	-	-	-	-
						CH ₃	CH ₃	FL5	H	H	H	H	-
138	Ir	3	0	Pi	DBF1	-	-	H	H	-	-	-	-
						CH ₃	CH ₃	FL5	H	H	H	H	-
139	Ir	3	0	Pi	DBT1	-	-	H	H	-	-	-	-
						CH ₃	CH ₃	FL5	H	H	H	H	-
140	Ir	3	0	Pi	Qn1	-	-	H	H	-	-	-	-
						CH ₃	Ph3	FL5	H	H	H	H	-
141	Ir	3	0	Pi	Qn2	-	-	H	H	-	-	-	-
						C ₆ H ₁₁	C ₆ H ₁₁	FL5	H	H	H	H	-
142	Ir	3	0	Pi	Cz	-	-	H	H	-	-	-	-
						CH ₃	CH ₃	FL5	H	H	H	H	-
143	Ir	3	0	Pi	Ph1	-	-	H	Ph2	H	FL5	H	H
						CH ₃	CH ₃	H	H	-	-	-	-
144	Ir	3	0	Pi	FL3	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-

Table 10

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
						R''	R'''	CyC1-R3	CyC1-R4	R5	R6	R7	R8
										CyC1			
145	Ir	3	0	Pi	FL3	-	-	H	CF ₃	-	-	-	-
146	Ir	3	0	Pi	DBF1	CH ₃	CH ₃	CF ₃	CF ₃	-	-	-	-
						-	-	H	H	-	-	-	-
147	Ir	3	0	Pi	DBT1	CH ₃	CH ₃	H	CH ₃	-	-	-	-
						-	-	H	H	-	-	-	-
148	Ir	3	0	Pi	FL3	-	-	H	FL6	H	H	H	-
						-	-	H	H	-	-	-	-
149	Ir	3	0	Pi	DBF1	-	-	H	DBF2	H	H	H	-
						-	-	H	H	-	-	-	-
150	Ir	3	0	Pi	DBT1	-	-	H	DBT3	H	H	H	-
						-	-	H	H	-	-	-	-
151	Rh	3	0	Pi	FL1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
152	Rh	3	0	Pi	FL1	-	-	H	CF ₃	-	-	-	-
						-	-	H	H	-	-	-	-
153	Rh	3	0	Pi	FL1	-	-	H	FL4	H	H	H	-
						-	-	H	H	-	-	-	-
154	Rh	3	0	Pi	FL1	-	-	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
155	Rh	3	0	Pi	FL1	-	-	H	Ph2	H	H	H	H
						-	-	H	H	-	-	-	-
156	Rh	3	0	Pi	FL1	-	-	H	FL4	H	Ph3	H	-
						-	-	H	Ph2	H	H	H	H
157	Rh	3	0	Pi	FL1	-	-	H	Np4	H	-	-	-
						-	-	H	H	-	-	-	-
158	Rh	3	0	Pi	Ph1	-	-	H	FL4	H	H	H	-
						-	-	H	H	-	-	-	-
159	Rh	3	0	Pi	Np2	-	-	H	FL4	H	H	H	-
						-	-	H	H	-	-	-	-
160	Rh	3	0	Pi	FL1	-	-	H	Ph2	H	FL4	H	H
						-	-	H	H	-	-	-	-

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Table 11

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
R''	R'''	CyC1-R3	CyC1-R4	CyC1									
R5	R6	R7	R8										
161	Rh	3	0	Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	FL4	H	H	H	H	-
162	Rh	3	0	Pi	Ph1	-	-	H	Ph2	H	FL4	H	H
						-	-	H	H	-	-	-	-
163	Rh	3	0	Pi	FL2	CH ₃	CH ₃	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
164	Rh	3	0	Pi	FL2	CH ₃	CH ₃	H	CF ₃	-	-	-	-
						-	-	H	H	-	-	-	-
165	Rh	3	0	Pi	FL2	CH ₃	CH ₃	CF ₃	CF ₃	-	-	-	-
						-	-	H	H	-	-	-	-
166	Rh	3	0	Pi	FL2	C ₂ H ₅	C ₂ H ₅	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
167	Rh	3	0	Pi	FL2	C ₃ H ₇	C ₃ H ₇	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
168	Rh	3	0	Pi	FL2	C ₄ H ₉	C ₄ H ₉	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
169	Rh	3	0	Pi	FL2	C ₅ H ₁₁	C ₅ H ₁₁	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
170	Rh	3	0	Pi	FL2	C ₆ H ₁₃	C ₆ H ₁₃	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
171	Rh	3	0	Pi	FL2	C ₁₅ H ₃₁	C ₁₅ H ₃₁	H	H	-	-	-	-
						-	-	H	OC ₄ H ₉	-	-	-	-
172	Rh	3	0	Pi	FL2	Ph3	Ph3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
173	Rh	3	0	Pi	FL2	CH ₃	Ph3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
174	Rh	3	0	Pi	FL2	(CH ₂) ₅ Ph3	(CH ₂) ₅ Ph3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
175	Rh	3	0	Pi	FL2	H	H	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
176	Rh	3	0	Pi	FL2	CH ₃	CH ₃	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-

Table 13

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
						R"	R'''	CyC1-R3	CyC1-R4	R5	R6	R7	R8
										CyC1			
193	Rh	3	0	Pi	FL2	CH ₃	CH ₃	H	FL4	H	Ph3	H	-
						-	-	H	Ph2	H	H	H	H
194	Rh	3	0	Pi	FL2	CH ₃	CH ₃	H	FL5	H	Ph3	H	-
						CH ₃	CH ₃	H	Ph2	H	H	H	H
195	Rh	3	0	Pi	FL2	Ph3	Ph3	H	FL5	H	Ph3	H	-
						Ph3	Ph3	H	Ph2	H	H	H	H
196	Rh	3	0	Pi	FL2	CH ₃	Ph3	H	FL5	H	Ph3	H	-
						CH ₃	Ph3	H	Ph2	H	H	H	H
197	Rh	3	0	Pi	FL2	(CH ₂) ₃ Ph3	(CH ₂) ₃ Ph3	H	FL5	H	Ph3	H	-
						CH ₃	CH ₃	H	Ph2	H	H	H	H
198	Rh	3	0	Pi	FL2	CH ₃	CH ₃	H	FL5	H	Ph3	H	-
						CH ₃	CH ₃	H	Tn5	C ₃ H ₇	H	-	-
199	Rh	3	0	Pi	Ph1	-	-	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
200	Rh	3	0	Pi	Ph1	-	-	H	FL5	H	H	H	-
						C ₃ H ₁₁	C ₃ H ₁₁	H	H	-	-	-	-
201	Rh	3	0	Pi	Ph1	-	-	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	CF3	-	-	-	-
202	Rh	3	0	Pi	Tn4	-	-	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
203	Rh	3	0	Pi	Np2	-	-	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
204	Rh	3	0	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	FL5	H	H
						CH ₃	CH ₃	H	H	-	-	-	-
205	Rh	3	0	Pi	FL2	CH ₃	CH ₃	H	Tn5	FL5	H	-	-
						CH ₃	CH ₃	H	H	-	-	-	-
206	Rh	3	0	Pi	FL2	CH ₃	CH ₃	H	Tn6	FL5	H	-	-
						CH ₃	CH ₃	H	H	-	-	-	-
207	Rh	3	0	Pi	FL2	CH ₃	CH ₃	H	Np3	FL5	H	-	-
						CH ₃	CH ₃	H	H	-	-	-	-
208	Rh	3	0	Pi	Ph1	-	-	H	H	-	-	-	-
						C ₈ H ₁₇	C ₈ H ₁₇	FL5	H	H	H	H	-

Table 14

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
						R''	R'''	CyC1-R3	CyC1-R4	R5	R6	R7	R8
										CyC1			
										R5	R6	R7	R8
209	Rh	3	0	Pi	Tn1	-	-	H	H	-	-	-	-
						CH ₃	CH ₃	FL5	H	H	H	H	-
210	Rh	3	0	Pi	Ph1	-	-	H	Ph2	H	FL5	H	H
						CH ₃	CH ₃	H	H	-	-	-	-
211	Pt	2	0	Pi	FL1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
212	Pt	2	0	Pi	FL1	-	-	H	CF ₃	-	-	-	-
						-	-	H	H	-	-	-	-
213	Pt	2	0	Pi	FL1	-	-	H	FL4	H	H	H	-
						-	-	H	H	-	-	-	-
214	Pt	2	0	Pi	FL1	-	-	H	DBT3	H	H	H	-
						-	-	H	H	-	-	-	-
215	Pt	2	0	Pi	FL1	-	-	H	Ph2	H	H	H	H
						-	-	H	H	-	-	-	-
216	Pt	2	0	Pi	FL1	-	-	H	FL4	H	Ph3	H	-
						-	-	H	Ph2	H	H	H	H
217	Pt	2	0	Pi	FL1	-	-	H	Np4	H	-	-	-
						-	-	H	H	-	-	-	-
218	Pt	2	0	Pi	Ph1	-	-	H	FL4	H	H	H	-
						-	-	H	H	-	-	-	-
219	Pt	2	0	Pi	Np2	-	-	H	FL4	H	H	H	-
						-	-	H	H	-	-	-	-
220	Pt	2	0	Pi	FL1	-	-	H	Ph2	H	FL4	H	H
						-	-	H	H	-	-	-	-
221	Pt	2	0	Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	FL4	H	H	H	H	-
222	Pt	2	0	Pi	Ph1	-	-	H	H	-	-	-	-
						C ₂ H ₅	C ₂ H ₅	FL5	H	H	H	H	-
223	Pt	2	0	Pi	Np2	-	-	H	Ph2	H	FL4	H	H
						-	-	H	H	-	-	-	-
224	Pt	2	0	Pi	FL2	CH ₃	CH ₃	H	H	-	-	-	-
						-	-	H	H	-	-	-	-

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Table 15

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
						R''	R'''	CyC1-R3	CyC1-R4	R5	R6	R7	R8
										CyC1			
225	Pt	2	0	Pi	FL2	CH ₃	CH ₃	H	CF ₃	-	-	-	-
						-	-	H	H	-	-	-	-
226	Pt	2	0	Pi	FL2	CH ₃	CH ₃	CF ₃	CF ₃	-	-	-	-
						-	-	H	H	-	-	-	-
227	Pt	2	0	Pi	FL2	Ph3	Ph3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
228	Pt	2	0	Pi	FL2	CH ₃	Ph3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
229	Pt	2	0	Pi	FL2	(CH ₂) ₅ Ph3	(CH ₂) ₅ Ph3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
230	Pt	2	0	Pi	FL2	CH ₃	CH ₃	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
231	Pt	2	0	Pi	FL2	C ₈ H ₁₁	C ₈ H ₁₁	H	FL5	H	H	H	-
						C ₈ H ₁₁	C ₈ H ₁₁	H	H	-	-	-	-
232	Pt	2	0	Pi	FL2	CH ₃	CH ₃	H	FL5	H	H	H	-
						C ₈ H ₁₇	C ₈ H ₁₇	H	H	-	-	-	-
233	Pt	2	0	Pi	FL2	Ph3	Ph3	H	FL5	H	H	H	-
						Ph3	Ph3	H	H	-	-	-	-
234	Pt	2	0	Pi	FL2	(CH ₂) ₅ Ph3	(CH ₂) ₅ Ph3	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
235	Pt	2	0	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	H	H	H
						-	-	H	H	-	-	-	-
236	Pt	2	0	Pi	FL2	CH ₃	CH ₃	H	Ph2	CF ₃	H	H	H
						-	-	H	H	-	-	-	-
237	Pt	2	0	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	OCH ₂ C ₅ F ₁₁	H	H
						-	-	H	H	-	-	-	-
238	Pt	2	0	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	OC≡C-C ₇ H ₁₅	H	H
						-	-	H	H	-	-	-	-
239	Pt	2	0	Pi	FL2	CH ₃	Ph3	H	An	H	-	-	-
						-	-	H	H	-	-	-	-
240	Pt	2	0	Pi	FL2	CH ₃	CH ₃	H	FL4	H	Ph3	H	-
						-	-	H	Ph2	H	H	H	H

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R''	R'''	CyC1-R3	CyC1-R4	CyC1			
R5	R6	R7	R8										
241	Pt	2	0	Pi	FL2	CH ₃	CH ₃	H	FL5	H	Ph3	H	-
						CH ₃	CH ₃	H	Ph2	H	H	H	H
242	Pt	2	0	Pi	FL2	Ph3	Ph3	H	FL5	H	Ph3	H	-
						Ph3	Ph3	H	Ph2	H	H	H	H
243	Pt	2	0	Pi	FL2	(CH ₂) ₃ Ph3	(CH ₂) ₃ Ph3	H	FL5	H	Ph3	H	-
						CH ₃	CH ₃	H	Ph2	H	H	H	H
244	Pt	2	0	Pi	FL2	CH ₃	CH ₃	H	FL5	H	Ph3	H	-
						CH ₃	CH ₃	H	Tn5	C ₃ H ₇	H	-	-
245	Pt	2	0	Pi	FL2	CH ₃	CH ₃	H	FL5	H	Ph3	H	-
						CH ₃	CH ₃	H	DBT3	H	H	-	-
246	Pt	2	0	Pi	Ph1	-	-	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
247	Pt	2	0	Pi	Ph1	-	-	H	FL5	H	H	H	-
						C ₅ H ₁₁	C ₅ H ₁₁	H	H	-	-	-	-
248	Pt	2	0	Pi	Ph1	-	-	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	CF3	-	-	-	-
249	Pt	2	0	Pi	Ph1	-	-	H	FL5	H	H	H	-
						Ph3	Ph3	H	H	-	-	-	-
250	Pt	2	0	Pi	Ph1	-	-	H	FL5	H	H	H	-
						CH ₃	Ph3	H	H	-	-	-	-
251	Pt	2	0	Pi	Tn1	-	-	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
252	Pt	2	0	Pi	Np2	-	-	H	FL5	H	H	H	-
						Ph3	Ph3	H	H	-	-	-	-
253	Pt	2	0	Pi	Pe2	-	-	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
254	Pt	2	0	Pi	Cn1	-	-	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	-	-	-	-	-
255	Pt	2	0	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	FL5	H	H
						CH ₃	CH ₃	H	H	-	-	-	-
256	Pt	2	0	Pi	FL2	CH ₃	CH ₃	H	Tn5	FL5	H	-	-
						CH ₃	CH ₃	H	H	-	-	-	-

Table 17

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
						R''	R'''	CyC1-R3	CyC1-R4	R5	R6	R7	R8
										CyC1			
257	Pt	2	0	Pi	FL2	CH ₃	CH ₃	H	Tn6	FL5	H	-	-
						CH ₃	CH ₃	H	H	-	-	-	-
258	Pt	2	0	Pi	FL2	CH ₃	CH ₃	H	FL4	FL5	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
259	Pt	2	0	Pi	FL2	CH ₃	CH ₃	H	FL5	FL5	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
260	Pt	2	0	Pi	FL2	CH ₃	CH ₃	H	FL6	FL5	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
261	Pt	2	0	Pi	FL2	CH ₃	CH ₃	H	DBF2	FL5	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
262	Pt	2	0	Pi	FL2	CH ₃	CH ₃	H	DBF3	FL5	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
263	Pt	2	0	Pi	Ph1	-	-	H	H	-	-	-	-
						C ₈ H ₁₇	C ₈ H ₁₇	FL5	H	H	H	H	-
264	Pt	2	0	Pi	Tn1	-	-	H	H	-	-	-	-
						CH ₃	CH ₃	FL5	H	H	H	H	-
265	Pt	2	0	Pi	Tn2	-	-	H	H	-	-	-	-
						CH ₃	CH ₃	FL5	H	H	H	H	-
266	Pt	2	0	Pi	Ph1	-	-	H	Ph2	H	FL5	H	H
						CH ₃	CH ₃	H	H	-	-	-	-
267	Pt	2	0	Pi	FL3	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
268	Pt	2	0	Pi	FL3	-	-	H	CF ₃	-	-	-	-
						-	-	H	H	-	-	-	-
269	Pt	2	0	Pi	DBF1	-	-	CF ₃	CF ₃	-	-	-	-
						-	-	H	H	-	-	-	-
270	Pt	2	0	Pi	DBT1	-	-	H	CH ₃	-	-	-	-
						-	-	H	H	-	-	-	-
271	Pd	2	0	Pi	FL1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
272	Pd	2	0	Pi	FL1	-	-	H	CF ₃	-	-	-	-
						-	-	H	H	-	-	-	-

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No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R''	R'''	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
273	Pd	2	0	Pi	FL1	—	—	H	FL4	H	H	H	—
						—	—	H	H	—	—	—	—
274	Pd	2	0	Pi	FL1	—	—	H	Ph2	H	H	H	H
						—	—	H	H	—	—	—	—
275	Pd	2	0	Pi	FL1	—	—	H	FL4	H	Ph3	H	—
						—	—	H	Ph2	H	H	H	H
276	Pd	2	0	Pi	FL1	—	—	H	Np4	H	—	—	—
						—	—	H	H	—	—	—	—
277	Pd	2	0	Pi	Ph1	—	—	H	FL4	H	H	H	—
						—	—	H	H	—	—	—	—
278	Pd	2	0	Pi	Np2	—	—	H	FL4	H	H	H	—
						—	—	H	H	—	—	—	—
279	Pd	2	0	Pi	FL1	—	—	H	Ph2	H	FL4	H	H
						—	—	H	H	—	—	—	—
280	Pd	2	0	Pi	Ph1	—	—	H	H	—	—	—	—
						—	—	FL4	H	H	H	H	—
281	Pd	2	0	Pi	Np2	—	—	H	Ph2	H	FL4	H	H
						—	—	H	H	—	—	—	—
282	Pd	2	0	Pi	FL2	CH ₃	CH ₃	H	H	—	—	—	—
						—	—	H	H	—	—	—	—
283	Pd	2	0	Pi	FL2	CH ₃	CH ₃	H	CF ₃	—	—	—	—
						—	—	H	H	—	—	—	—
284	Pd	2	0	Pi	FL2	(CH ₂) ₅ Ph3	(CH ₂) ₅ Ph3	H	H	—	—	—	—
						—	—	H	H	—	—	—	—
285	Pd	2	0	Pi	FL2	CH ₃	CH ₃	H	FL5	H	H	H	—
						CH ₃	CH ₃	H	H	—	—	—	—
286	Pd	2	0	Pi	FL2	C ₆ H ₁₁	C ₆ H ₁₁	H	FL5	H	H	H	—
						C ₆ H ₁₁	C ₆ H ₁₁	H	H	—	—	—	—
287	Pd	2	0	Pi	FL2	(CH ₂) ₅ Ph3	(CH ₂) ₅ Ph3	H	FL5	H	H	H	—
						CH ₃	CH ₃	H	H	—	—	—	—
288	Pd	2	0	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	H	H	H
						—	—	H	H	—	—	—	—

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R''	R'''	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
273	Pd	2	0	Pi	FL1	—	—	H	FL4	H	H	H	—
						—	—	H	H	—	—	—	—
274	Pd	2	0	Pi	FL1	—	—	H	Ph2	H	H	H	H
						—	—	H	H	—	—	—	—
275	Pd	2	0	Pi	FL1	—	—	H	FL4	H	Ph3	H	—
						—	—	H	Ph2	H	H	H	H
276	Pd	2	0	Pi	FL1	—	—	H	Np4	H	—	—	—
						—	—	H	H	—	—	—	—
277	Pd	2	0	Pi	Ph1	—	—	H	FL4	H	H	H	—
						—	—	H	H	—	—	—	—
278	Pd	2	0	Pi	Np2	—	—	H	FL4	H	H	H	—
						—	—	H	H	—	—	—	—
279	Pd	2	0	Pi	FL1	—	—	H	Ph2	H	FL4	H	H
						—	—	H	H	—	—	—	—
280	Pd	2	0	Pi	Ph1	—	—	H	H	—	—	—	—
						—	—	FL4	H	H	H	H	—
281	Pd	2	0	Pi	Np2	—	—	H	Ph2	H	FL4	H	H
						—	—	H	H	—	—	—	—
282	Pd	2	0	Pi	FL2	CH ₃	CH ₃	H	H	—	—	—	—
						—	—	H	H	—	—	—	—
283	Pd	2	0	Pi	FL2	CH ₃	CH ₃	H	CF ₃	—	—	—	—
						—	—	H	H	—	—	—	—
284	Pd	2	0	Pi	FL2	(CH ₂) ₅ Ph3	(CH ₂) ₅ Ph3	H	H	—	—	—	—
						—	—	H	H	—	—	—	—
285	Pd	2	0	Pi	FL2	CH ₃	CH ₃	H	FL5	H	H	H	—
						CH ₃	CH ₃	H	H	—	—	—	—
286	Pd	2	0	Pi	FL2	C ₅ H ₁₁	C ₅ H ₁₁	H	FL5	H	H	H	—
						C ₅ H ₁₁	C ₅ H ₁₁	H	H	—	—	—	—
287	Pd	2	0	Pi	FL2	(CH ₂) ₅ Ph3	(CH ₂) ₅ Ph3	H	FL5	H	H	H	—
						CH ₃	CH ₃	H	H	—	—	—	—
288	Pd	2	0	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	H	H	H
						—	—	H	H	—	—	—	—

Table 19

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R''	R'''	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
289	Pd	2	0	Pi	FL2	CH ₃	CH ₃	H	Ph2	CF ₃	H	H	H
						-	-	H	H	-	-	-	-
290	Pd	2	0	Pi	FL2	CH ₃	CH ₃	H	FL4	H	Ph3	H	-
						-	-	H	Ph2	H	H	H	H
291	Pd	2	0	Pi	FL2	CH ₃	CH ₃	H	FL5	H	Ph3	H	-
						CH ₃	CH ₃	H	Ph2	H	H	H	H
292	Pd	2	0	Pi	FL2	Ph3	Ph3	H	FL5	H	Ph3	H	-
						Ph3	Ph3	H	Ph2	H	H	H	H
293	Pd	2	0	Pi	FL2	CH ₃	CH ₃	H	FL5	H	Ph3	H	-
						CH ₃	CH ₃	H	DBT3	H	H	-	-
294	Pd	2	0	Pi	Ph1	-	-	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
295	Pd	2	0	Pi	Ph1	-	-	H	FL5	H	H	H	-
						C ₅ H ₁₁	C ₅ H ₁₁	H	H	-	-	-	-
296	Pd	2	0	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	FL5	H	H
						CH ₃	CH ₃	H	H	-	-	-	-
297	Pd	2	0	Pi	FL2	CH ₃	CH ₃	H	Tn5	FL5	H	-	-
						CH ₃	CH ₃	H	H	-	-	-	-
298	Pd	2	0	Pi	Ph1	-	-	H	H	-	-	-	-
						C ₈ H ₁₇	C ₈ H ₁₇	FL5	H	H	H	H	-
299	Pd	2	0	Pi	Ph1	-	-	H	Ph2	H	FL5	H	H
						CH ₃	CH ₃	H	H	-	-	-	-
300	Pd	2	0	Pi	DBT1	-	-	H	CH ₃	-	-	-	-
						-	-	H	H	-	-	-	-

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No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1							
						R''	R'''	CyC1-R3	CyC1-R4	R5	R6	R7	R8				
										CyC1							
										R5	R6	R7	R8				
										CyN2							
R	R'	CyN2-R1	CyN2-R2	R5	R6	R7	R8										
R''	R'''	CyC2-R3	CyC2-R4	CyC2													
				R5	R6	R7	R8										
				301	Ir	2	1	Pi	FL1	-	-	H	H	-	-	-	-
										-	-	H	H	-	-	-	-
Pi	Ph1	-	-					H	H	-	-	-	-				
		-	-					H	H	-	-	-	-				
302	Ir	2	1	Pi	FL1	-	-	H	FL4	H	H	H	-				
						-	-	H	H	-	-	-	-				
				Pi	Ph1	-	-	H	H	-	-	-	-				
						-	-	H	H	-	-	-	-				
303	Ir	2	1	Pi	FL1	-	-	H	Ph2	H	H	H	H				
						-	-	H	H	-	-	-	-				
				Pi	Ph1	-	-	H	H	-	-	-	-				
						-	-	H	H	-	-	-	-				
304	Ir	2	1	Pi	FL1	-	-	H	FL4	H	Ph3	H	-				
						-	-	H	Ph2	H	H	H	H				
				Pi	Ph1	-	-	H	H	-	-	-	-				
						-	-	H	H	-	-	-	-				
305	Ir	2	1	Pi	FL1	-	-	H	Np4	H	-	-	-				
						-	-	H	H	-	-	-	-				
				Pi	Ph1	-	-	H	H	-	-	-	-				
						-	-	H	H	-	-	-	-				
306	Ir	2	1	Pi	Ph1	-	-	H	FL4	H	H	H	-				
						-	-	H	H	-	-	-	-				
				Pi	Ph1	-	-	H	H	-	-	-	-				
						-	-	H	H	-	-	-	-				
307	Ir	2	1	Pi	Np2	-	-	H	FL4	H	H	H	-				
						-	-	H	H	-	-	-	-				
				Pi	Ph1	-	-	H	H	-	-	-	-				
						-	-	H	H	-	-	-	-				
308	Ir	2	1	Pi	FL1	-	-	H	Ph2	H	FL4	H	H				
						-	-	H	H	-	-	-	-				
				Pi	Ph1	-	-	H	H	-	-	-	-				
						-	-	H	H	-	-	-	-				
309	Ir	2	1	Pi	Ph1	-	-	H	H	-	-	-	-				
						-	-	FL4	H	H	H	H	-				
				Pi	Ph1	-	-	H	H	-	-	-	-				
						-	-	H	H	-	-	-	-				
310	Ir	2	1	Pi	Ph1	-	-	H	Ph2	H	FL4	H	H				
						-	-	H	H	-	-	-	-				
				Pi	Ph1	-	-	H	H	-	-	-	-				
						-	-	H	H	-	-	-	-				

Table 20													
No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
						R''	R'''	CyC1-R3	CyC1-R4	R5	R6	R7	R8
										CyC1			
										R5	R6	R7	R8
										CyN2			
R''	R'''	CyC2-R3	CyC2-R4	R	R'	CyN2-R1	CyN2-R2	R5	R6	R7	R8		
				CyC2									
				R5	R6	R7	R8						
				R5	R6	R7	R8						
301	Ir	2	1	Pi	FL1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
302	Ir	2	1	Pi	FL1	-	-	H	FL4	H	H	H	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
303	Ir	2	1	Pi	FL1	-	-	H	Ph2	H	H	H	H
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
304	Ir	2	1	Pi	FL1	-	-	H	FL4	H	Ph3	H	-
						-	-	H	Ph2	H	H	H	H
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
305	Ir	2	1	Pi	FL1	-	-	H	Np4	H	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
306	Ir	2	1	Pi	Ph1	-	-	H	FL4	H	H	H	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
307	Ir	2	1	Pi	Np2	-	-	H	FL4	H	H	H	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
308	Ir	2	1	Pi	FL1	-	-	H	Ph2	H	FL4	H	H
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
309	Ir	2	1	Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	FL4	H	H	H	H	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
310	Ir	2	1	Pi	Ph1	-	-	H	Ph2	H	FL4	H	H
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-

Table 21

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
										CyC1			
										R5	R6	R7	R8
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
										CyC2			
										R5	R6	R7	R8
										R5	R6	R7	R8
311	Ir	2	1	Pi	FL2	CH ₃	CH ₃	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
312	Ir	2	1	Pi	FL2	CH ₃	CH ₃	H	CF ₃	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
313	Ir	2	1	Pi	FL2	CH ₃	CH ₃	CF ₃	CF ₃	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
314	Ir	2	1	Pi	FL2	CH ₃	CH ₃	H	H	-	-	-	-
						-	-	H	OC ₆ H ₉	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
315	Ir	2	1	Pi	FL2	C ₈ H ₁₇	C ₈ H ₁₇	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
316	Ir	2	1	Pi	FL2	Ph3	Ph3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
317	Ir	2	1	Pi	FL2	CH ₃	Ph3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
318	Ir	2	1	Pi	FL2	(CH ₂) ₅ Ph3	(CH ₂) ₅ Ph3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
319	Ir	2	1	Pi	FL2	H	H	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
320	Ir	2	1	Pi	FL2	CH ₃	CH ₃	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	Cl	H	-	-	-	-

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1				
						R''	R'''	CyC1-R3	CyC1-R4	R5	R6		R7	R8
										CyC1				
										R5	R6		R7	R8
										CyN2				
R''	R'''	CyC2-R3	CyC2-R4	R5	R6		R7	R8						
				CyC2										
				R5	R6		R7	R8						
				CyC2										
321	Ir	2	1	Pi	FL2	C ₂ H ₅	C ₂ H ₅	H	FL5	H	H	H	-	
						C ₂ H ₅	C ₂ H ₅	H	H	-	-	-	-	
				Pr	Ph1	-	-	H	H	-	-	-	-	
						-	-	H	H	-	-	-	-	
322	Ir	2	1	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	H	H	H	
						-	-	H	H	-	-	-	-	
				Pr	Ph1	-	-	H	H	-	-	-	-	
						-	-	H	H	-	-	-	-	
323	Ir	2	1	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	OCH ₂ C ₆ F ₁₁	H	H	
						-	-	H	H	-	-	-	-	
				Py1	Ph1	-	-	H	H	-	-	-	-	
						-	-	H	H	-	-	-	-	
324	Ir	2	1	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	OC≡C-C ₇ H ₁₅	H	H	
						-	-	H	H	-	-	-	-	
				Py2	Ph1	-	-	H	H	-	-	-	-	
						-	-	H	H	-	-	-	-	
325	Ir	2	1	Pi	FL2	CH ₃	CH ₃	H	FL5	H	Ph3	H	-	
						CH ₃	CH ₃	H	Ph2	H	H	H	H	
				Pi	Ph1	-	-	H	H	-	-	-	-	
						-	-	CH ₃	H	-	-	-	-	
326	Ir	2	1	Pi	FL2	CH ₃	CH ₃	H	FL5	H	Ph3	H	-	
						CH ₃	CH ₃	H	Tn8	H	H	-	-	
				Pi	Ph1	-	-	H	H	-	-	-	-	
						-	-	Br	H	-	-	-	-	
327	Ir	2	1	Pi	Ph1	-	-	H	FL5	H	H	H	-	
						CH ₃	CH ₃	H	H	-	-	-	-	
				Pi	Ph1	-	-	H	H	-	-	-	-	
						-	-	CF ₃	H	-	-	-	-	
328	Ir	2	1	Pi	Ph1	-	-	H	FL5	H	H	H	-	
						Ph3	Ph3	H	H	-	-	-	-	
				Pi	Ph1	-	-	H	H	-	-	-	-	
						-	-	C ₆ H ₁₁	H	-	-	-	-	
329	Ir	2	1	Pi	Np2	-	-	H	FL5	H	H	H	-	
						Ph3	Ph3	H	H	-	-	-	-	
				Pi	Ph1	-	-	H	H	-	-	-	-	
						-	-	OCH ₃	H	-	-	-	-	
330	Ir	2	1	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	FL5	H	H	
						CH ₃	CH ₃	H	H	-	-	-	-	
				Pi	Ph1	-	-	H	H	-	-	-	-	
						-	-	Cl	H	-	-	-	-	

Table 22													
No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
						R''	R'''	CyC1-R3	CyC1-R4	R5	R6	R7	R8
										CyC1			
										R5	R6	R7	R8
										CyN2			
										R5	R6	R7	R8
R''	R'''	CyC2-R3	CyC2-R4	CyC2									
R5	R6	R7	R8										
321	Ir	2	1	Pi	FL2	C ₂ H ₅	C ₂ H ₅	H	FL5	H	H	H	-
						C ₂ H ₅	C ₂ H ₅	H	H	-	-	-	-
				Pr	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
322	Ir	2	1	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	H	H	H
						-	-	H	H	-	-	-	-
				Pr	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
323	Ir	2	1	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	OCH ₂ C ₆ F ₁₁	H	H
						-	-	H	H	-	-	-	-
				Py1	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
324	Ir	2	1	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	OC≡C-C ₇ H ₁₅	H	H
						-	-	H	H	-	-	-	-
				Py2	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
325	Ir	2	1	Pi	FL2	CH ₃	CH ₃	H	FL5	H	Ph3	H	-
						CH ₃	CH ₃	H	Ph2	H	H	H	H
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	CH ₃	H	-	-	-	-
326	Ir	2	1	Pi	FL2	CH ₃	CH ₃	H	FL5	H	Ph3	H	-
						CH ₃	CH ₃	H	Tn8	H	H	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	Br	H	-	-	-	-
327	Ir	2	1	Pi	Ph1	-	-	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	CF ₃	H	-	-	-	-
328	Ir	2	1	Pi	Ph1	-	-	H	FL5	H	H	H	-
						Ph3	Ph3	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	C ₆ H ₁₁	H	-	-	-	-
329	Ir	2	1	Pi	Np2	-	-	H	FL5	H	H	H	-
						Ph3	Ph3	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	OCH ₃	H	-	-	-	-
330	Ir	2	1	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	FL5	H	H
						CH ₃	CH ₃	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	Cl	H	-	-	-	-

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R''	R'''	CyC1-R3	CyC1-R4	CyC1			
						R	R'	CyN2-R1	CyN2-R2	R5	R6	R7	R8
						R''	R'''	CyC2-R3	CyC2-R4	CyC2			
331	Ir	2	1	Pi	FL2	CH ₃	CH ₃	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Tn1	-	-	H	CF ₃	-	-	-	-
						-	-	H	H	-	-	-	-
332	Ir	2	1	Pi	FL2	CH ₃	CH ₃	CF ₃	CF ₃	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Tn1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
333	Ir	2	1	Pi	FL2	CH ₃	CH ₃	H	H	-	-	-	-
						-	-	H	OC ₄ H ₉	-	-	-	-
				Pi	Tn2	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
334	Ir	2	1	Pi	FL2	C ₄ H ₉	C ₄ H ₉	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Tn3	-	-	H	H	-	-	-	-
						-	-	H	CH ₃	-	-	-	-
335	Ir	2	1	Pi	FL2	C ₈ H ₁₇	C ₈ H ₁₇	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Tn4	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
336	Ir	2	1	Pi	FL2	H	H	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
				Pi	Np1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
337	Ir	2	1	Pi	FL2	CH ₃	CH ₃	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
				Pi	Np2	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
338	Ir	2	1	Pi									

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
						R''	R'''	CyC1-R3	CyC1-R4	R5	R6	R7	R8
										CyC1			
										R5	R6	R7	R8
										CyN2			
CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	R5	R6	R7	R8				
		R''	R'''	CyC2-R3	CyC2-R4	CyC2							
						R5	R6	R7	R8				
						R5	R6	R7	R8				
331	Ir	2	1	Pi	FL2	CH ₃	CH ₃	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Tn1	-	-	H	CF ₃	-	-	-	-
-	-	H	H			-	-	-	-				
332	Ir	2	1	Pi	FL2	CH ₃	CH ₃	CF ₃	CF ₃	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Tn1	-	-	H	H	-	-	-	-
-	-	H	H			-	-	-	-				
333	Ir	2	1	Pi	FL2	CH ₃	CH ₃	H	H	-	-	-	-
						-	-	H	OC ₄ H ₉	-	-	-	-
				Pi	Tn2	-	-	H	H	-	-	-	-
-	-	H	H			-	-	-	-				
334	Ir	2	1	Pi	FL2	C ₄ H ₉	C ₄ H ₉	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Tn3	-	-	H	H	-	-	-	-
-	-	H	CH ₃			-	-	-	-				
335	Ir	2	1	Pi	FL2	C ₈ H ₁₇	C ₈ H ₁₇	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Tn4	-	-	H	H	-	-	-	-
-	-	H	H			-	-	-	-				
336	Ir	2	1	Pi	FL2	H	H	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
				Pi	Np1	-	-	H	H	-	-	-	-
-	-	H	H			-	-	-	-				
337	Ir	2	1	Pi	FL2	CH ₃	CH ₃	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
				Pi	Np2	-	-	H	H	-	-	-	-
-	-	H	H			-	-	-	-				
338	Ir	2	1	Pi	FL2	C ₁₅ H ₃₁	C ₁₅ H ₃₁	H	FL5	H	H	H	-
						C ₁₅ H ₃₁	C ₁₅ H ₃₁	H	H	-	-	-	-
				Pi	Pe1	-	-	H	H	-	-	-	-
-	-	H	H			-	-	-	-				
339	Ir	2	1	Pi	FL2	CH ₃	Ph3	H	FL5	H	H	H	-
						CH ₃	Ph3	H	H	-	-	-	-
				Pi	Cn1	-	-	H	H	-	-	-	-
-	-	H	-			-	-	-	-				
340	Ir	2	1	Pi	FL2	(CH ₂) ₅ Ph3	(CH ₂) ₅ Ph3	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
				Pi	Cn2	-	-	H	H	-	-	-	-
-	-	H	-			-	-	-	-				

Table 24

Table 2-4													
No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
						R''	R'''	CyC1-R3	CyC1-R4	R5	R6	R7	R8
										CyC1			
										R5	R6	R7	R8
CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2							
		R''	R'''	CyC2-R3	CyC2-R4	R5	R6	R7	R8				
						CyC2							
						R5	R6	R7	R8				
341	Ir	2	1	Pi	FL2	CH ₃	CH ₃	H	DBT3	H	H	H	-
						-	-	H	H	-	-	-	-
				Pi	FL1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
342	Ir	2	1	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	H	H	H
						-	-	H	H	-	-	-	-
				Pi	FL2	CH ₃	CH ₃	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
343	Ir	2	1	Pi	FL2	C ₃ H ₇	C ₃ H ₇	H	Tn5	H	H	-	-
						-	-	H	H	-	-	-	-
				Pi	FL2	CH ₃	CH ₃	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
344	Ir	2	1	Pi	FL2	CH ₃	CH ₃	H	Np3	H	H	-	-
						-	-	H	H	-	-	-	-
				Pi	FL2	CH ₃	CH ₃	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
345	Ir	2	1	Pi	FL2	C ₈ H ₁₇	C ₈ H ₁₇	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	FL2	(CH ₂) ₅ Ph3	(CH ₂) ₅ Ph3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
346	Ir	2	1	Pi	FL2	Ph3	Ph3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	FL2	C ₃ H ₇	C ₃ H ₇	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
347	Ir	2	1	Pi	FL2	CH ₃	Ph3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	FL3	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
348	Ir	2	1	Pi	FL2	(CH ₂) ₅ Ph3	(CH ₂) ₅ Ph3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	DBF1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
349	Ir	2	1	Pi	FL2	H	H	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
				Pi	DBT1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
350	Ir	2	1	Pi	FL2	CH ₃	CH ₃	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
				Pi	Qn1	-	-	H	H	-	-	-	-
						-	-	Cl	H	-	-	-	-

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Table 25

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
						R''	R'''			R5	R6	R7	R8
										CyC1			
										R5	R6	R7	R8
										CyN2			
						R	R'	CyN2-R1	CyN2-R2	CyC2			
						R''	R'''			R5	R6	R7	R8
										CyC1			
										R5	R6	R7	R8
										CyC2			
351	Ir	2	1	Pi	FL2	C ₂ H ₅	C ₂ H ₅	H	FL5	H	H	H	-
						C ₂ H ₅	C ₂ H ₅			-	-	-	-
						-	-			-	-	-	-
						-	-			-	-	-	-
						-	-			-	-	-	-
352	Ir	2	1	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	H	H	H
						-	-			-	-	-	-
						-	-			-	-	-	-
						-	-			-	-	-	-
						-	-			-	-	-	-
353	Rh	2	1	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	OCH ₂ C ₈ F ₁₁	H	H
						-	-			-	-	-	-
						-	-			-	-	-	-
						-	-			-	-	-	-
						-	-			-	-	-	-
354	Rh	2	1	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	OC≡C-C ₇ H ₁₅	H	H
						-	-			-	-	-	-
						-	-			-	-	-	-
						-	-			-	-	-	-
						-	-			-	-	-	-
355	Rh	2	1	Pi	FL2	CH ₃	CH ₃	H	FL5	H	Ph3	H	-
						CH ₃	CH ₃			H	H	H	H
						-	-			-	-	-	-
						-	-			-	-	-	-
						-	-			-	-	-	-
356	Rh	2	1	Pi	FL2	CH ₃	CH ₃	H	FL5	H	Ph3	H	-
						CH ₃	CH ₃			H	H	-	-
						-	-			-	-	-	-
						-	-			-	-	-	-
						-	-			-	-	-	-
357	Rh	2	1	Pi	Ph1	-	-	H	FL5	H	H	H	-
						CH ₃	CH ₃			-	-	-	-
						-	-			-	-	-	-
						-	-			-	-	-	-
						-	-			-	-	-	-
358	Rh	2	1	Pi	Ph1	-	-	H	FL5	H	H	H	-
						Ph3	Ph3			-	-	-	-
						-	-			-	-	-	-
						-	-			-	-	-	-
						-	-			-	-	-	-
359	Rh	2	1	Pi	Np2	-	-	H	FL5	H	H	H	-
						Ph3	Ph3			-	-	-	-
						-	-			-	-	-	-
						-	-			-	-	-	-
						-	-			-	-	-	-
360	Rh	2	1	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	FL5	H	H
						CH ₃	CH ₃			-	-	-	-
						-	-			-	-	-	-
						-	-			-	-	-	-
						-	-			-	-	-	-

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Table 26

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
										CyC1			
										R5	R6	R7	R8
										CyN2			
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	R5	R6	R7	R8
361	Ir	1	2	Pi	FL1	-	-	H	H	-	-	-	-
362	Ir	1	2	Pi	Ph1	-	-	H	H	-	-	-	-
363	Ir	1	2	Pi	FL1	-	-	H	FL4	H	H	H	-
364	Ir	1	2	Pi	Ph1	-	-	H	H	-	-	-	-
365	Ir	1	2	Pi	FL1	-	-	H	Ph2	H	H	H	H
366	Ir	1	2	Pi	Ph1	-	-	H	H	-	-	-	-
367	Ir	1	2	Pi	Np2	-	-	H	FL4	H	H	H	-
368	Ir	1	2	Pi	FL1	-	-	H	Ph2	H	FL4	H	H
369	Ir	1	2	Pi	Ph1	-	-	H	H	-	-	-	-
370	Ir	1	2	Pi	Ph1	-	-	H	Ph2	H	FL4	H	H

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Table 27

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
						R''	R'''			R5	R6	R7	R8
										CyC1			
										R5	R6	R7	R8
										CyN2			
						R	R'	CyN2-R1	CyN2-R2	CyC2			
										R5	R6	R7	R8
										CyC1			
										R5	R6	R7	R8
										CyC2			
371	Ir	1	2	Pi	FL2	CH ₃	CH ₃	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
372	Ir	1	2	Pi	FL2	CH ₃	CH ₃	H	CF ₃	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
373	Ir	1	2	Pi	FL2	CH ₃	CH ₃	CF ₃	CF ₃	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
374	Ir	1	2	Pi	FL2	CH ₃	CH ₃	H	H	-	-	-	-
						-	-	H	OC ₄ H ₉	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
375	Ir	1	2	Pi	FL2	C ₈ H ₁₇	C ₈ H ₁₇	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
376	Ir	1	2	Pi	FL2	Ph3	Ph3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
377	Ir	1	2	Pi	FL2	CH ₃	Ph3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
378	Ir	1	2	Pi	FL2	(CH ₂) ₅ Ph3	(CH ₂) ₅ Ph3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
379	Ir	1	2	Pi	FL2	H	H	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
380	Ir	1	2	Pi	FL2	CH ₃	CH ₃	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
						-	-	Cl	H	-	-	-	-

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
										CyC1			
										R5	R6	R7	R8
										CyN2			
No	M	m	n	CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyC2			
										R5	R6	R7	R8
										CyC1			
										R5	R6	R7	R8
										CyN2			
381	Ir	1	2	Pi	FL2	C ₂ H ₅	C ₂ H ₅	H	FL5	H	H	H	-
						C ₂ H ₅	C ₂ H ₅	H	H	-	-	-	-
				Pr	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
382	Ir	1	2	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	H	H	H
						-	-	H	H	-	-	-	-
				Pr	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
383	Ir	1	2	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	OCH ₂ C ₆ F ₁₁	H	H
						-	-	H	H	-	-	-	-
				Py1	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
384	Ir	1	2	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	OC≡C-C ₇ H ₁₅	H	H
						-	-	H	H	-	-	-	-
				Py2	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
385	Ir	1	2	Pi	FL2	CH ₃	CH ₃	H	FL5	H	Ph3	H	-
						CH ₃	CH ₃	H	Ph2	H	H	H	H
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	CH ₃	H	-	-	-	-
386	Ir	1	2	Pi	FL2	CH ₃	CH ₃	H	FL5	H	Ph3	H	-
						CH ₃	CH ₃	H	Tn8	H	H	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	Br	H	-	-	-	-
387	Ir	1	2	Pi	Ph1	-	-	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	CF ₃	H	-	-	-	-
388	Ir	1	2	Pi	Ph1	-	-	H	FL5	H	H	H	-
						Ph3	Ph3	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	C ₆ H ₁₁	H	-	-	-	-
389	Ir	1	2	Pi	Np2	-	-	H	FL5	H	H	H	-
						Ph3	Ph3	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	OCH ₃	H	-	-	-	-
390	Ir	1	2	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	FL5	H	H
						CH ₃	CH ₃	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	Cl	H	-	-	-	-

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
										CyC1			
										R5	R6	R7	R8
										CyN2			
No	M	m	n	CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyC2			
										R5	R6	R7	R8
										CyC1			
										R5	R6	R7	R8
										CyN2			
381	Ir	1	2	Pi	FL2	C ₂ H ₅	C ₂ H ₅	H	FL5	H	H	H	-
						C ₂ H ₅	C ₂ H ₅	H	H	-	-	-	-
				Pr	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
382	Ir	1	2	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	H	H	H
						-	-	H	H	-	-	-	-
				Pr	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
383	Ir	1	2	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	OCH ₂ C ₆ F ₁₁	H	H
						-	-	H	H	-	-	-	-
				Py1	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
384	Ir	1	2	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	OC≡C-C ₇ H ₁₅	H	H
						-	-	H	H	-	-	-	-
				Py2	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
385	Ir	1	2	Pi	FL2	CH ₃	CH ₃	H	FL5	H	Ph3	H	-
						CH ₃	CH ₃	H	Ph2	H	H	H	H
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	CH ₃	H	-	-	-	-
386	Ir	1	2	Pi	FL2	CH ₃	CH ₃	H	FL5	H	Ph3	H	-
						CH ₃	CH ₃	H	Tn8	H	H	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	Br	H	-	-	-	-
387	Ir	1	2	Pi	Ph1	-	-	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	CF ₃	H	-	-	-	-
388	Ir	1	2	Pi	Ph1	-	-	H	FL5	H	H	H	-
						Ph3	Ph3	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	C ₆ H ₁₁	H	-	-	-	-
389	Ir	1	2	Pi	Np2	-	-	H	FL5	H	H	H	-
						Ph3	Ph3	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	OCH ₃	H	-	-	-	-
390	Ir	1	2	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	FL5	H	H
						CH ₃	CH ₃	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	Cl	H	-	-	-	-

Table 29

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
						R''	R'''			R5	R6	R7	R8
				CyN2	CyC2	CyC1-R3		CyC1-R4	CyC1-R4	CyC1			
						R	R'			R5	R6	R7	R8
						R''	R'''			CyN2			
391	Ir	1	2	Pi	FL2	CyC2-R3		CyC2-R4	CyC2-R4	CyC2			
						R	R'			R5	R6	R7	R8
						R''	R'''			CyC1			
						R	R'			R5	R6	R7	R8
392	Ir	1	2	Pi	FL2	CH ₃	CH ₃	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
						-	-	H	CF ₃	-	-	-	-
						-	-	H	H	-	-	-	-
393	Ir	1	2	Pi	FL2	CH ₃	CH ₃	CF ₃	CF ₃	-	-	-	-
						-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
394	Ir	1	2	Pi	FL2	CH ₃	CH ₃	H	H	-	-	-	-
						-	-	H	OC ₄ H ₉	-	-	-	-
						-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
395	Ir	1	2	Pi	FL2	C ₄ H ₉	C ₄ H ₉	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
						-	-	H	CH ₃	-	-	-	-
396	Ir	1	2	Pi	FL2	C ₈ H ₁₇	C ₈ H ₁₇	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
397	Ir	1	2	Pi	FL2	H	H	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
398	Ir	1	2	Pi	FL2	CH ₃	CH ₃	H	FL5	H	H	H	-
						-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
399	Ir	1	2	Pi	FL2	CH ₃	Ph3	H	FL5	H	H	H	-
						CH ₃	Ph3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
400	Ir	1	2	Pi	FL2	(CH ₂) ₅ Ph3	(CH ₂) ₅ Ph3	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-

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Table 30

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1					
						R''	R'''	CyC1-R3	CyC1-R4	R5	R6	R7	R8		
										CyC1					
										R5	R6	R7	R8		
										CyN2					
										R5	R6	R7	R8		
						R''	R'''	CyC2-R3	CyC2-R4	CyC2					
						R5	R6	R7	R8						
401	Ir	1	2	Pi	FL2	CH ₃	CH ₃	H	DBT3	H	H	H	-		
						-	-	H	H	-	-	-	-		
						Pi	FL1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-		
402	Ir	1	2	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	H	H	H		
						-	-	H	H	-	-	-	-		
						Pi	FL2	CH ₃	CH ₃	H	H	-	-	-	-
						-	-	H	H	-	-	-	-		
403	Ir	1	2	Pi	FL2	C ₃ H ₇	C ₃ H ₇	H	Tn5	H	H	-	-		
						-	-	H	H	-	-	-	-		
						Pi	FL2	CH ₃	CH ₃	H	H	-	-	-	-
						-	-	H	H	-	-	-	-		
404	Ir	1	2	Pi	FL2	CH ₃	CH ₃	H	Np3	H	H	-	-		
						-	-	H	H	-	-	-	-		
						Pi	FL2	CH ₃	CH ₃	H	H	-	-	-	-
						-	-	H	H	-	-	-	-		
405	Ir	1	2	Pi	FL2	C ₈ H ₁₇	C ₈ H ₁₇	H	H	-	-	-	-		
						-	-	H	H	-	-	-	-		
						Pi	FL2	(CH ₂) ₅ Ph3	(CH ₂) ₅ Ph3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-		
406	Ir	1	2	Pi	FL2	Ph3	Ph3	H	H	-	-	-	-		
						-	-	H	H	-	-	-	-		
						Pi	FL2	C ₃ H ₇	C ₃ H ₇	H	H	-	-	-	-
						-	-	H	H	-	-	-	-		
407	Ir	1	2	Pi	FL2	CH ₃	Ph3	H	H	-	-	-	-		
						-	-	H	H	-	-	-	-		
						Pi	FL3	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-		
408	Ir	1	2	Pi	FL2	(CH ₂) ₅ Ph3	(CH ₂) ₅ Ph3	H	H	-	-	-	-		
						-	-	H	H	-	-	-	-		
						Pi	DBT1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-		
409	Ir	1	2	Pi	FL2	H	H	H	FL5	H	H	H	-		
						CH ₃	CH ₃	H	H	-	-	-	-		
						Pi	DBT1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-		
410	Ir	1	2	Pi	FL2	CH ₃	CH ₃	H	FL5	H	H	H	-		
						CH ₃	CH ₃	H	H	-	-	-	-		
						Pi	Qn1	-	-	H	H	-	-	-	-
						-	-	Cl	H	-	-	-	-		

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Table 31

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
						R''	R'''	CyC1-R3	CyC1-R4	R5	R6	R7	R8
						CyC1				R5	R6	R7	R8
						R	R'	CyN2-R1	CyN2-R2	R5	R6	R7	R8
						R''	R'''	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
411	Ir	1	2	Pi	FL2	C ₂ H ₅	C ₂ H ₅	H	FL5	H	H	H	-
						C ₂ H ₅	C ₂ H ₅	H	H	-	-	-	-
				Pr	Qn2	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
412	Ir	1	2	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	H	H	H
						-	-	H	H	-	-	-	-
				Pr	Cz	-	-	H	H	-	-	-	-
						-	-	Ph3	H	-	-	-	-
413	Rh	1	2	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	OCH ₂ C ₃ F ₁₁	H	H
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
414	Rh	1	2	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	OC≡C-C ₇ H ₁₅	H	H
						-	-	H	H	-	-	-	-
				Py2	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
415	Rh	1	2	Pi	FL2	CH ₃	CH ₃	H	FL5	H	Ph3	H	-
						CH ₃	CH ₃	H	Ph2	H	H	H	H
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	CH ₃	H	-	-	-	-
416	Rh	1	2	Pi	FL2	CH ₃	CH ₃	H	FL5	H	Ph3	H	-
						CH ₃	CH ₃	H	Tn8	H	H	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	Br	H	-	-	-	-
417	Rh	1	2	Pi	Ph1	-	-	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	CF ₃	H	-	-	-	-
418	Rh	1	2	Pi	Ph1	-	-	H	FL5	H	H	H	-
						Ph3	Ph3	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	C ₆ H ₁₁	H	-	-	-	-
419	Rh	1	2	Pi	Np2	-	-	H	FL5	H	H	H	-
						Ph3	Ph3	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	OCH ₃	H	-	-	-	-
420	Rh	1	2	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	FL5	H	H
						CH ₃	CH ₃	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	Cl	H	-	-	-	-

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	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100	2101	2102	2103	2104	2105	2106	2107	2108	2109	2110	2111	2112	2113	2114	2115	2116	2117	2118	2119	2120	2121	2122	2123	2124	2125	2126	2127	2128	2129	2130	2131	2132	2133	2134	2135	2136	2137	2138	2139	2140	2141	2142	2143	2144	2145	2146	2147	2148	2149	2150	2151	2152	2153	2154	2155	2156	2157	2158	2159	2160	2161	2162	2163	2164	2165	2166	2167	2168	2169	2170	2171	2172	2173	2174	2175	2176	2177	2178	2179	2180	2181	2182	2183	2184	2185	2186	2187	2188	2189	2190	2191	2192	2193	2194	2195	2196	2197	2198	2199	2200	2201	2202	2203	2204	2205	2206	2207	2208	2209	2210	2211	2212	2213	2214	2215	2216	2217	2218	2219	2220	2221	2222	2223	2224	2225	2226	2227	2228	2229	2230	2231	2232	2233	2234	2235	2236	2237	2238	2239	2240	2241	2242	2243	2244	2245	2246	2247	2248	2249	2250	2251	2252	2253	2254	2255	2256	2257	2258	2259	2260	2261	2262	2263	2264	2265	2266	2267	2268	2269	2270	2271	2272	2273	2274	2275	2276	2277	2278	2279	2280	2281	2282	2283	2284	2285	2286	2287	2288	2289	2290	2291	2292	2293	2294	2295	2296	2297	2298	2299	2300	2301	2302	2303	2304	2305	2306	2307	2308	2309	2310	2311	2312	2313	2314	2315	2316	2317	2318	2319	2320	2321	2322	2323	2324	2325	2326	2327	2328	2329	2330	2331	2332	2333	2334	2335	2336	2337	2338	2339	2340	2341	2342	2343	2344	2345	2346	2347	2348	2349	2350	2351	2352	2353	2354	2355	2356	2357	2358	2359	2360	2361	2362	2363	2364	2365	2366	2367	2368	2369	2370	2371	2372	2373	2374	2375	2376	2377	2378	2379	2380	2381	2382	2383	2384	2385	2386	2387	2388	2389	2390	2391	2392	2393	2394	2395	2396	2397	2398	2399	2400	2401	2402	2403	2404	2405	2406	2407	2408	2409	2410	2411	2412	2413	2414	2415	2416	2417	2418	2419	2420	2421	2422	2
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No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1							
						R''	R'''	CyC1-R3	CyC1-R4	R5	R6	R7	R8				
										CyC1							
										R5	R6	R7	R8				
										CyN2							
R	R'	CyN2-R1	CyN2-R2	R5	R6	R7	R8										
R''	R'''	CyC2-R3	CyC2-R4	CyC2													
				R5	R6	R7	R8										
				421	Pt	1	1	Pi	FL1	-	-	H	H	-	-	-	-
										-	-	H	H	-	-	-	-
Pi	Ph1	-	-					H	H	-	-	-	-				
		-	-					H	H	-	-	-	-				
422	Pt	1	1	Pi	FL1	-	-	H	FL4	H	H	H	-				
						-	-	H	H	-	-	-	-				
				Pi	Ph1	-	-	H	H	-	-	-	-				
						-	-	H	H	-	-	-	-				
423	Pt	1	1	Pi	FL1	-	-	H	Ph2	H	H	H	H				
						-	-	H	H	-	-	-	-				
				Pi	Ph1	-	-	H	H	-	-	-	-				
						-	-	H	H	-	-	-	-				
424	Pt	1	1	Pi	FL1	-	-	H	FL4	H	Ph3	H	-				
						-	-	H	Ph2	H	H	H	H				
				Pi	Ph1	-	-	H	H	-	-	-	-				
						-	-	H	H	-	-	-	-				
425	Pt	1	1	Pi	FL1	-	-	H	Np4	H	-	-	-				
						-	-	H	H	-	-	-	-				
				Pi	Ph1	-	-	H	H	-	-	-	-				
						-	-	H	H	-	-	-	-				
426	Pt	1	1	Pi	FL2	CH ₃	CH ₃	H	H	-	-	-	-				
						-	-	H	H	-	-	-	-				
				Pi	Ph1	-	-	H	H	-	-	-	-				
						-	-	H	H	-	-	-	-				
427	Pt	1	1	Pi	FL2	CH ₃	CH ₃	H	CF ₃	-	-	-	-				
						-	-	H	H	-	-	-	-				
				Pi	Ph1	-	-	H	H	-	-	-	-				
						-	-	H	H	-	-	-	-				
428	Pt	1	1	Pi	FL2	CH ₃	CH ₃	CF ₃	CF ₃	-	-	-	-				
						-	-	H	H	-	-	-	-				
				Pi	Ph1	-	-	H	H	-	-	-	-				
						-	-	H	H	-	-	-	-				
429	Pt	1	1	Pi	FL2	CH ₃	CH ₃	H	H	-	-	-	-				
						-	-	H	OC ₄ H ₉	-	-	-	-				
				Pi	Ph1	-	-	H	H	-	-	-	-				
						-	-	H	H	-	-	-	-				
430	Pt	1	1	Pi	FL2	C ₈ H ₁₇	C ₈ H ₁₇	H	H	-	-	-	-				
						-	-	H	H	-	-	-	-				
				Pi	Ph1	-	-	H	H	-	-	-	-				
						-	-	H	H	-	-	-	-				

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100
1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100	

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
						R	R'	CyC1-R3	CyC1-R4	R5	R6	R7	R8
										CyC1			
										R5	R6	R7	R8
										CyN2			
										R5	R6	R7	R8
R	R'	CyC2-R3	CyC2-R4	CyC2									
				R5	R6	R7	R8						
				CyC2									
				R5	R6	R7	R8						
				CyC2									
431	Pt	1	1	Pi	FL2	C ₂ H ₅	C ₂ H ₅	H	FL5	H	H	H	-
						C ₂ H ₅	C ₂ H ₅	H	H	-	-	-	-
				Pr	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
432	Pt	1	1	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	H	H	H
						-	-	H	H	-	-	-	-
				Pr	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
433	Pt	1	1	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	OCH ₂ C ₆ F ₁₁	H	H
						-	-	H	H	-	-	-	-
				Py1	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
434	Pt	1	1	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	OC≡C-C ₇ H ₁₅	H	H
						-	-	H	H	-	-	-	-
				Py2	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
435	Pt	1	1	Pi	FL2	CH ₃	CH ₃	H	FL5	H	Ph3	H	-
						CH ₃	CH ₃	H	Ph2	H	H	H	H
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	CH ₃	H	-	-	-	-
436	Pt	1	1	Pi	FL2	CH ₃	CH ₃	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Tn1	-	-	H	CF ₃	-	-	-	-
						-	-	H	H	-	-	-	-
437	Pt	1	1	Pi	FL2	CH ₃	CH ₃	CF ₃	CF ₃	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Tn1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
438	Pt	1	1	Pi	FL2	CH ₃	CH ₃	H	H	-	-	-	-
						-	-	H	OC ₄ H ₉	-	-	-	-
				Pi	Tn2	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
439	Pt	1	1	Pi	FL2	C ₄ H ₉	C ₄ H ₉	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Tn3	-	-	H	H	-	-	-	-
						-	-	H	CH ₃	-	-	-	-
440	Pt	1	1	Pi	FL2	C ₈ H ₁₇	C ₈ H ₁₇	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Tn4	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-

Table 34

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1									
						R''	R'''			R5	R6	R7	R8						
						CyN2	CyC2			R	R'	CyC1-R3	CyC1-R4	CyC1					
										R''	R'''			R5	R6	R7	R8		
										R	R'			CyN2-R1	CyN2-R2	CyN2			
										R''	R'''					R5	R6	R7	R8
						R5	R6	R7	R8										
						CyC2													
441	Pt	1	1	Pi	FL2	CH ₃	CH ₃	H	DBT3	H	H	H	-						
						-	-	H	H	-	-	-	-						
				Pi	FL1	-	-	H	H	-	-	-	-						
						-	-	H	H	-	-	-	-						
442	Pt	1	1	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	H	H	H						
						-	-	H	H	-	-	-	-						
				Pi	FL2	CH ₃	CH ₃	H	H	-	-	-	-						
						-	-	H	H	-	-	-	-						
443	Pt	1	1	Pi	FL2	C ₃ H ₇	C ₃ H ₇	H	Tn5	H	H	-	-						
						-	-	H	H	-	-	-	-						
				Pi	FL2	CH ₃	CH ₃	H	H	-	-	-	-						
						-	-	H	H	-	-	-	-						
444	Pt	1	1	Pi	FL2	CH ₃	CH ₃	H	Np3	H	H	-	-						
						-	-	H	H	-	-	-	-						
				Pi	FL2	CH ₃	CH ₃	H	H	-	-	-	-						
						-	-	H	H	-	-	-	-						
445	Pt	1	1	Pi	FL2	C ₈ H ₁₇	C ₈ H ₁₇	H	H	-	-	-	-						
						-	-	H	H	-	-	-	-						
				Pi	FL2	(CH ₂) ₅ Ph3	(CH ₂) ₅ Ph3	H	H	-	-	-	-						
						-	-	H	H	-	-	-	-						
446	Pt	1	1	Pi	FL2	C ₂ H ₅	C ₂ H ₅	H	FL5	H	H	H	-						
						C ₂ H ₅	C ₂ H ₅	H	H	-	-	-	-						
				Pr	Qn2	-	-	H	H	-	-	-	-						
						-	-	H	H	-	-	-	-						
447	Pt	1	1	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	H	H	H						
						-	-	H	H	-	-	-	-						
				Pr	Cz	-	-	H	H	-	-	-	-						
						-	-	Ph3	H	-	-	-	-						
448	Pt	1	1	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	OCH ₂ C ₅ F ₁₁	H	H						
						-	-	H	H	-	-	-	-						
				Pi	Ph1	-	-	H	H	-	-	-	-						
						-	-	H	H	-	-	-	-						
449	Pt	1	1	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	OC≡C-C ₇ H ₁₅	H	H						
						-	-	H	H	-	-	-	-						
				Py2	Ph1	-	-	H	H	-	-	-	-						
						-	-	H	H	-	-	-	-						
450	Pt	1	1	Pi	FL2	CH ₃	CH ₃	H	FL5	H	Ph3	H	-						
						CH ₃	CH ₃	H	Ph2	H	H	H	H						
				Pi	Ph1	-	-	H	H	-	-	-	-						
						-	-	CH ₃	H	-	-	-	-						

Table 35

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1					
						R''	R'''			CyC1-R3	CyC1-R4	R5	R6	R7	R8
												CyC1			
												R5	R6	R7	R8
												CyN2			
												R5	R6	R7	R8
R''	R'''	CyC2-R3	CyC2-R4	CyC2											
				R5	R6	R7	R8								
451	Pt	1	1	Pi	Ph1	-	-	H	FL4	H	H	H	-		
						-	-	H	H	-	-	-	-		
				Pi	Ph1	-	-	H	H	-	-	-	-		
						-	-	H	H	-	-	-	-		
452	Pt	1	1	Pi	Np2	-	-	H	FL4	H	H	H	-		
						-	-	H	H	-	-	-	-		
				Pi	Ph1	-	-	H	H	-	-	-	-		
						-	-	H	H	-	-	-	-		
453	Pt	1	1	Pi	FL1	-	-	H	Ph2	H	FL4	H	H		
						-	-	H	H	-	-	-	-		
				Pi	Ph1	-	-	H	H	-	-	-	-		
						-	-	H	H	-	-	-	-		
454	Pt	1	1	Pi	Ph1	-	-	H	H	-	-	-	-		
						-	-	FL4	H	H	H	H	-		
				Pi	Ph1	-	-	H	H	-	-	-	-		
						-	-	H	H	-	-	-	-		
455	Pt	1	1	Pi	Ph1	-	-	H	Ph2	H	FL4	H	H		
						-	-	H	H	-	-	-	-		
				Pi	Ph1	-	-	H	H	-	-	-	-		
						-	-	H	H	-	-	-	-		
456	Pt	1	1	Pi	FL2	Ph3	Ph3	H	H	-	-	-	-		
						-	-	H	H	-	-	-	-		
				Pi	Ph1	-	-	H	H	-	-	-	-		
						-	-	H	H	-	-	-	-		
457	Pt	1	1	Pi	FL2	CH ₃	Ph3	H	H	-	-	-	-		
						-	-	H	H	-	-	-	-		
				Pi	Ph1	-	-	H	H	-	-	-	-		
						-	-	H	H	-	-	-	-		
458	Pt	1	1	Pi	FL2	(CH ₂) ₅ Ph3	(CH ₂) ₅ Ph3	H	H	-	-	-	-		
						-	-	H	H	-	-	-	-		
				Pi	Ph1	-	-	H	H	-	-	-	-		
						-	-	H	H	-	-	-	-		
459	Pt	1	1	Pi	FL2	H	H	H	FL5	H	H	H	-		
						CH ₃	CH ₃	H	H	-	-	-	-		
				Pi	Ph1	-	-	H	H	-	-	-	-		
						-	-	H	H	-	-	-	-		
460	Pt	1	1	Pi	FL2	CH ₃	CH ₃	H	FL5	H	H	H	-		
						CH ₃	CH ₃	H	H	-	-	-	-		
				Pi	Ph1	-	-	H	H	-	-	-	-		
						-	-	Cl	H	-	-	-	-		

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Table 36

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1							
						R''	R'''	CyC1-R3	CyC1-R4	R5	R6	R7	R8				
										CyC1							
										R5	R6	R7	R8				
										CyN2							
R	R'	CyN2-R1	CyN2-R2	R5	R6	R7	R8										
R''	R'''	CyC2-R3	CyC2-R4	CyC2													
				R5	R6	R7	R8										
				461	Pt	1	1	Pi	FL2	CH ₃	CH ₃	H	FL5	H	Ph3	H	-
										CH ₃	CH ₃	H	Tn8	H	H	-	-
Pi	Ph1	-	-					H	H	-	-	-	-				
		-	-					Br	H	-	-	-	-				
462	Pt	1	1	Pi	Ph1	-	-	H	FL5	H	H	H	-				
						CH ₃	CH ₃	H	H	-	-	-	-				
				Pi	Ph1	-	-	H	H	-	-	-	-				
						-	-	CF ₃	H	-	-	-	-				
463	Pt	1	1	Pi	Ph1	-	-	H	FL5	H	H	H	-				
						Ph3	Ph3	H	H	-	-	-	-				
				Pi	Ph1	-	-	H	H	-	-	-	-				
						-	-	C ₅ H ₁₁	H	-	-	-	-				
464	Pt	1	1	Pi	Np2	-	-	H	FL5	H	H	H	-				
						Ph3	Ph3	H	H	-	-	-	-				
				Pi	Ph1	-	-	H	H	-	-	-	-				
						-	-	OCH ₃	H	-	-	-	-				
465	Pt	1	1	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	FL5	H	H				
						CH ₃	CH ₃	H	H	-	-	-	-				
				Pi	Ph1	-	-	H	H	-	-	-	-				
						-	-	Cl	H	-	-	-	-				
466	Pd	1	1	Pi	FL2	H	H	H	FL5	H	H	H	-				
						CH ₃	CH ₃	H	H	-	-	-	-				
				Pi	Np1	-	-	H	H	-	-	-	-				
						-	-	H	H	-	-	-	-				
467	Pd	1	1	Pi	FL2	CH ₃	CH ₃	H	FL5	H	H	H	-				
						CH ₃	CH ₃	H	H	-	-	-	-				
				Pi	Np2	-	-	H	H	-	-	-	-				
						-	-	H	H	-	-	-	-				
468	Pd	1	1	Pi	FL2	C ₁₅ H ₃₁	C ₁₅ H ₃₁	H	FL5	H	H	H	-				
						C ₁₅ H ₃₁	C ₁₆ H ₃₁	H	H	-	-	-	-				
				Pi	Pe1	-	-	H	H	-	-	-	-				
						-	-	H	H	-	-	-	-				
469	Pd	1	1	Pi	FL2	CH ₃	Ph3	H	FL5	H	H	H	-				
						CH ₃	Ph3	H	H	-	-	-	-				
				Pi	Cn1	-	-	H	H	-	-	-	-				
						-	-	H	H	-	-	-	-				
470	Pd	1	1	Pi	FL2	(CH ₂) ₅ Ph3	(CH ₂) ₅ Ph3	H	FL5	H	H	H	-				
						CH ₃	CH ₃	H	H	-	-	-	-				
				Pi	Cn2	-	-	H	H	-	-	-	-				
						-	-	H	H	-	-	-	-				

Table 37

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
						R''	R'''			R5	R6	R7	R8
										CyC1			
										R5	R6	R7	R8
										CyN2			
										R5	R6	R7	R8
471	Pd	1	1	Pi	FL2	R	R'	CyN2-R1	CyN2-R2	CyC2			
						R''	R'''			R5	R6	R7	R8
										CyC1			
										R5	R6	R7	R8
										CyN2			
										R5	R6	R7	R8
472	Pd	1	1	Pi	FL2	Ph3	Ph3	H	H	R5	R6	R7	R8
						-	-	H	H	-	-	-	-
						C ₃ H ₇	C ₃ H ₇	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
473	Pd	1	1	Pi	FL2	(CH ₂) ₃ Ph3	(CH ₂) ₃ Ph3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
474	Pd	1	1	Pi	FL2	H	H	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
475	Pd	1	1	Pi	FL2	CH ₃	CH ₃	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
						-	-	Cl	H	-	-	-	-
						-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
476	Pd	1	1	Pi	FL2	CH ₃	CH ₃	H	FL5	H	Ph3	H	-
						CH ₃	CH ₃	H	Tn8	H	H	-	-
						-	-	H	H	-	-	-	-
						-	-	Br	H	-	-	-	-
						-	-	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
477	Pd	1	1	Pi	Ph1	-	-	H	FL5	H	H	H	-
						-	-	H	H	-	-	-	-
						-	-	CF ₃	H	-	-	-	-
						-	-	H	FL5	H	H	H	-
						Ph3	Ph3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
478	Pd	1	1	Pi	Ph1	-	-	C ₆ H ₁₁	H	-	-	-	-
						-	-	H	FL5	H	H	H	-
						Ph3	Ph3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
						-	-	OCH ₃	H	-	-	-	-
						-	-	H	H	-	-	-	-
479	Pd	1	1	Pi	Np2	-	-	H	FL5	H	H	H	-
						Ph3	Ph3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
						-	-	OCH ₃	H	-	-	-	-
						-	-	H	H	-	-	-	-
480	Pd	1	1	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	FL5	H	H
						CH ₃	CH ₃	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
						-	-	Cl	H	-	-	-	-
						-	-	H	H	-	-	-	-

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Table 38

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
R''	R'''	CyC1-R3	CyC1-R4	CyC1									
R5	R6	R7	R8										
481	Ir	3	0	Pi	FL1	-	-	H	H	-	-	-	-
						-	-	-CH=CH-CH=CH-	-	-	-	-	-
482	Ir	3	0	Pi	FL1	-	-	H	CF ₃	-	-	-	-
						-	-	-CH=CH-CH=CH-	-	-	-	-	-
483	Ir	3	0	Pi	FL1	-	-	H	FL4	H	H	H	-
						-	-	-CH=CH-CH=CH-	-	-	-	-	-
484	Ir	3	0	Pi	FL1	-	-	H	Ph2	H	H	H	H
						-	-	-CH=CH-CH=CH-	-	-	-	-	-
485	Ir	3	0	Pi	FL1	-	-	H	FL4	H	Ph3	H	-
						-	-	-CH=CH-CH=CH-	H	H	H	H	H
486	Ir	3	0	Pi	FL1	-	-	H	Np4	H	-	-	-
						-	-	-CH=CH-CH=CH-	-	-	-	-	-
487	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	H	-	-	-	-
						-	-	-CH=CH-CH=CH-	-	-	-	-	-
488	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	CF ₃	-	-	-	-
						-	-	-CH=CH-CH=CH-	-	-	-	-	-
489	Ir	3	0	Pi	FL2	CH ₃	CH ₃	CF ₃	CF ₃	-	-	-	-
						-	-	-CH=CH-CH=CH-	-	-	-	-	-
490	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	CH ₃	-	-	-	-
						-	-	-CH=CH-CH=CH-	-	-	-	-	-
491	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	H	-	-	-	-
						-	-	-CH=CH-CH=CH-	-	-	-	-	-
492	Ir	3	0	Pi	FL2	C ₂ H ₅	C ₂ H ₅	H	H	-	-	-	-
						-	-	-CH=CH-CH=CH-	-	-	-	-	-
493	Ir	3	0	Pi	FL2	C ₃ H ₇	C ₃ H ₇	H	H	-	-	-	-
						-	-	-CH=CH-CH=CH-	-	-	-	-	-
494	Ir	3	0	Pi	FL2	C ₄ H ₉	C ₄ H ₉	H	H	-	-	-	-
						-	-	-CH=CH-CH=CH-	-	-	-	-	-
495	Ir	3	0	Pi	FL2	Ph3	Ph3	H	H	-	-	-	-
						-	-	-CH=CH-CH=CH-	-	-	-	-	-
496	Ir	3	0	Pi	FL2	CH ₃	Ph3	H	H	-	-	-	-
						-	-	-CH=CH-CH=CH-	-	-	-	-	-
497	Ir	3	0	Pi	FL2	H	H	H	FL5	H	H	H	-
						CH ₃	CH ₃	-CH=CH-CH=CH-	-	-	-	-	-
498	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	FL5	H	H	H	-
						CH ₃	CH ₃	-CH=CH-CH=CH-	-	-	-	-	-
499	Ir	3	0	Pi	FL2	C ₂ H ₅	C ₂ H ₅	H	FL5	H	H	H	-
						C ₂ H ₅	C ₂ H ₅	-CH=CH-CH=CH-	-	-	-	-	-
500	Ir	3	0	Pi	FL2	C ₈ H ₁₁	C ₈ H ₁₁	H	FL5	H	H	H	-
						C ₈ H ₁₁	C ₈ H ₁₁	-CH=CH-CH=CH-	-	-	-	-	-
501	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	FL5	H	H	H	-
						C ₈ H ₁₇	C ₈ H ₁₇	-CH=CH-CH=CH-	-	-	-	-	-
502	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	H	H	H
						-	-	-CH=CH-CH=CH-	-	-	-	-	-

Table 39

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
						R''	R'''	CyC1-R3	CyC1-R4	R5	R6	R7	R8
										CyC1			
										R5	R6	R7	R8
503	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	Ph2	CF ₃	H	H	H
						-	-	-CH=CH-CH=CH-	-	-	-	-	-
504	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	OCH ₂ C ₅ F ₁₁	H	H
						-	-	-CH=CH-CH=CH-	-	-	-	-	-
505	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	OC≡C-C ₇ H ₁₅	H	H
						-	-	-CH=CH-CH=CH-	-	-	-	-	-
506	Ir	3	0	Pi	FL2	C ₃ H ₇	C ₃ H ₇	H	Tn5	H	H	-	-
						-	-	-CH=CH-CH=CH-	-	-	-	-	-
507	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	Tn6	H	H	-	-
						-	-	-CH=CH-CH=CH-	-	-	-	-	-
508	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	Np3	H	H	-	-
						-	-	-CH=CH-CH=CH-	-	-	-	-	-
509	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	Np4	H	-	-	-
						-	-	-CH=CH-CH=CH-	-	-	-	-	-
510	Ir	3	0	Pi	FL2	CH ₃	CH ₃	H	Tn7	H	H	-	-
						-	-	-CH=CH-CH=CH-	-	-	-	-	-

Table 40

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
										CyC1			
										R5	R6	R7	R8
										E			
						E	R''	R'''		R5	R6	R7	R8
						G	R''	R'''		R5	R6	R7	R8
										G			
										R5	R6	R7	R8
511	Ir	2	1	Pi	FL1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
						CH ₃	-	-	-	-	-	-	-
						CH ₃	-	-	-	-	-	-	-
512	Ir	2	1	Pi	FL1	-	-	H	CF ₃	-	-	-	-
						-	-	H	H	-	-	-	-
						CF ₃	-	-	-	-	-	-	-
						CF ₃	-	-	-	-	-	-	-
513	Ir	2	1	Pi	FL2	CH ₃	CH ₃	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
						CH ₃	-	-	-	-	-	-	-
						CH ₃	-	-	-	-	-	-	-
514	Ir	2	1	Pi	FL2	CH ₃	CH ₃	H	CF ₃	-	-	-	-
						-	-	H	H	-	-	-	-
						Ph2	-	-	-	H	H	H	H
						Ph2	-	-	-	H	H	H	H
515	Ir	2	1	Pi	FL2	CH ₃	CH ₃	H	H	-	-	-	-
						-	-	H	OC ₄ H ₉	-	-	-	-
						Ph2	-	-	-	H	C ₃ H ₇	H	H
						Ph2	-	-	-	H	C ₃ H ₇	H	H
516	Ir	2	1	Pi	FL2	C ₆ H ₁₃	C ₆ H ₁₃	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
						CH ₃	-	-	-	-	-	-	-
						FL5	CH ₃	CH ₃	-	H	H	H	-
517	Ir	2	1	Pi	FL2	H	H	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
						Tn5	-	-	-	H	H	-	-
						Tn5	-	-	-	H	H	-	-
518	Ir	2	1	Pi	FL2	CH ₃	CH ₃	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
						Tn6	-	-	-	H	H	-	-
						Tn6	-	-	-	H	H	-	-
519	Ir	2	1	Pi	FL2	Ph3	Ph3	H	FL5	H	H	H	-
						Ph3	Ph3	H	H	-	-	-	-
						CH ₃	-	-	-	-	-	-	-
						CH ₃	-	-	-	-	-	-	-
520	Ir	2	1	Pi	FL2	CH ₃	Ph3	H	FL5	H	H	H	-
						CH ₃	Ph3	H	H	-	-	-	-
						CF ₃	-	-	-	-	-	-	-
						CF ₃	-	-	-	-	-	-	-

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Table 41

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1				
										R5	R6	R7	R8	
										CyC1				
										R5	R6	R7	R8	
										E				
						E	R''	R'''			R5	R6	R7	R8
						G	R''	R'''			G			
											R5	R6	R7	R8
521	Ir	2	1	Pi	FL2	(CH ₂) ₅ Ph3	(CH ₂) ₅ Ph3	H	FL5	H	H	H	-	
						CH ₃	CH ₃	H	H	-	-	-	-	
						Np3	-	-	CH ₃ O	H	-	-		
						Np3	-	-	CH ₃ O	H	-	-		
522	Ir	2	1	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	H	H	H	
						-	-	H	H	-	-	-	-	
						Np4	-	-	F	-	-	-		
						Np4	-	-	F	-	-	-		
523	Ir	2	1	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	OCH ₂ C ₈ F ₁₁	H	H	
						-	-	H	H	-	-	-	-	
						Tn7	-	-	CH ₃	-	-	-		
						Tn7	-	-	CH ₃	-	-	-		
524	Ir	2	1	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	OC≡C-C ₇ H ₁₅	H	H	
						-	-	H	H	-	-	-	-	
						Tn8	-	-	H	-	-	-		
						Tn8	-	-	H	-	-	-		
525	Ir	2	1	Pi	FL2	C ₃ H ₇	C ₃ H ₇	H	Tn5	H	H	-	-	
						-	-	H	H	-	-	-	-	
						Pe2	-	-	H	-	-	-		
						Pe2	-	-	H	-	-	-		
526	Ir	2	1	Pi	FL2	CH ₃	CH ₃	H	FL4	H	Ph3	H	-	
						-	-	H	Ph2	H	H	H	H	
						Pi2	-	-	H	H	-	-		
						Pi2	-	-	H	H	-	-		
527	Ir	2	1	Pi	FL2	CH ₃	CH ₃	H	FL5	H	Ph3	H	-	
						CH ₃	CH ₃	H	Ph2	H	H	H	H	
						Pi3	-	-	CH ₃	CH ₃	H	H		
						Pi3	-	-	CH ₃	CH ₃	H	H		
528	Ir	2	1	Pi	Ph1	-	-	H	FL5	H	H	H	-	
						CH ₃	CH ₃	H	H	-	-	-	-	
						FL4	-	-	H	H	H	-		
						FL4	-	-	H	H	H	-		
529	Ir	2	1	Pi	FL2	CH ₃	CH ₃	H	Ph2	H	FL5	H	H	
						CH ₃	CH ₃	H	H	-	-	-	-	
						FL5	C ₂ H ₅	C ₂ H ₅	H	H	H	-		
						FL5	(CH ₂) ₅ Ph3	(CH ₂) ₅ Ph3	H	H	H	-		
530	Ir	2	1	Pi	Ph1	-	-	H	H	-	-	-	-	
						C ₈ H ₁₇	C ₈ H ₁₇	FL5	H	H	H	-		
						DBF2	-	-	H	H	H	-		
						DBF2	-	-	H	H	H	-		

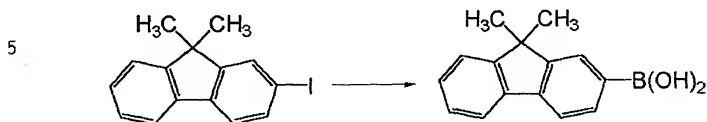
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Table 42

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R''	R'''	CyC1-R3	CyC1-R4	CyC1			
						E	R''	R'''		R5	R6	R7	R8
										E			
						G	R''	R'''		R5	R6	R7	R8
										G			
531	Ir	2	1	Pi	Ph1					R5	R6	R7	R8
						-	-	H	Ph2	H	FL5	H	H
						CH ₃	CH ₃	H	H	-	-	-	-
						DBT3	-	-	-	H	H	H	-
532	Rh	2	1	Pi	FL3					H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
						CH ₃	-	-	-	-	-	-	-
533	Rh	2	1	Pi	DBF1					-	-	-	-
						CH ₃	CH ₃	CF ₃	CF ₃	-	-	-	-
						-	-	H	H	-	-	-	-
						CF ₃	-	-	-	-	-	-	-
534	Rh	2	1	Pi	FL1					-	-	-	-
						CH ₃	CH ₃	H	FL5	H	H	H	-
						Qn2	-	-	-	-	-	-	-
						Qn2	-	-	-	H	H	-	-
535	Rh	2	1	Pi	Np2					H	H	H	-
						-	-	H	FL4	H	H	-	-
						-	-	H	H	-	-	-	-
						Np3	-	-	-	H	H	-	-
536	Pt	1	1	Pi	FL2					-	-	-	-
						C ₃ H ₇	C ₃ H ₇	H	H	-	-	-	-
						CH ₃	-	H	H	-	-	-	-
						CH ₃	-	-	-	-	-	-	-
537	Pt	1	1	Pi	FL2					-	-	-	-
						C ₅ H ₁₁	C ₅ H ₁₁	H	H	-	-	-	-
						CF ₃	-	H	H	-	-	-	-
						CF ₃	-	-	-	-	-	-	-
538	Pd	1	1	Pi	FL2					-	-	-	-
						C ₁₅ H ₃₁	C ₁₅ H ₃₁	H	FL5	H	H	H	-
						C ₁₅ H ₃₁	C ₁₅ H ₃₁	H	H	-	-	-	-
						CH ₃	-	-	-	-	-	-	-
539	Pd	1	1	Pi	FL2					-	-	-	-
						CH ₃	CH ₃	H	Np3	H	H	-	-
						-	-	H	H	-	-	-	-
						CF ₃	-	-	-	-	-	-	-
540	Ir	1	2	Pi	Tn4					-	-	-	-
						-	-	H	FL5	H	H	H	-
						CH ₃	CH ₃	H	H	-	-	-	-
						CH ₃	-	-	-	-	-	-	-

Hereinbelow, the present invention will be described more specifically based on Examples.

Example 1 (Synthesis of Example Compound No. 23)



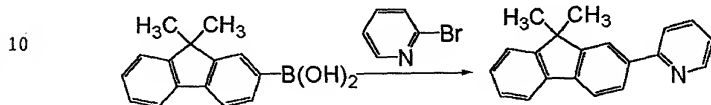
10 In a 30 liter-three-necked flask, 307.3 g (960 mM) of 2-iodo-9,9-dimethylfluorene and 10 liters of dry THF (tetrahydrofuran) were placed and cooled to -72 to 70 °C under stirring in an argon gas stream atmosphere. To the mixture, a 1.6M solution of n-butyllithium in hexane was added dropwise in 1 hour, followed by further stirring for 2 hours at the

15 temperature. Thereafter, under stirring at -73 to -71 °C, to the system, a solution of 209.5 g (2016 mM) of trimethyl borate in 1.3 liters of dry THT was added dropwise in 2 hours. The reaction mixture was left standing overnight on an ice water bath. To the

20 mixture, 1.6 liters of 4N-hydrochloric acid was added in 0.5 hour at 0 - 7 °C, followed by stirring for 1 hour at room temperature and extraction with toluene. The organic layer was washed with saturated saline water, followed by distilling-off of the solvent under

25 a reduced pressure to obtain a residue. To the residue, hexane was added and heated under heating, followed by cooling to precipitate a crystal. The

crystal was recovered by filtration and purified by silica gel column chromatography (eluent: toluene/ethyl acetate = 1/1), followed by successive recrystallization from a chloroform-hexane mixture solvent, toluene, an ethyl acetate-toluene-THF mixture solvent, and toluene to obtain 32.0 g of 2-(9,9-dimethylfluorenyl)boronic acid (colorless crystal) (Yield: 14.0 %).



In a 300 ml-three-necked flask, 8.5 g (53.8 mM) of 2-bromopyridine, 12.8 g (53.8 mM) of 2-(9,9-dimethylfluorenyl)boronic acid, 55 ml of toluene, 27 ml of ethanol and 55 ml of 2M-sodium carbonate aqueous solution were placed and stirred at room temperature under nitrogen stream, and 1.97 g (1.70 mM) of tetrakis(triphenylphosphine)palladium (0) was added thereto. Thereafter, reflux under stirring for 5.5 hours was performed under nitrogen stream. After the reaction, the reaction mixture was cooled and extracted by addition of cold water and toluene. The organic layer was washed with water until neutrality, and the solvent was removed under reduced pressure to obtain a residue. The residue was successively purified by silica gel column chromatography (eluent:

5



20

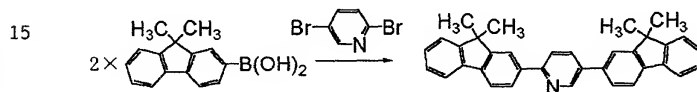
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desorption ionization-time of flight mass spectroscopy), the compound exhibited M^+ (mass number of the corresponding cation formed by removal of 1 electron) of 1003.4.

5 A toluene solution of the compound exhibited a photoluminescence spectrum showing λ_{\max} (maximum emission wavelength) = 545 nm and a quantum yield of 0.23.

10 The compound (Ex. Comp. No. 23) exhibited better synthesis yield and quantum yield, thus being most suitable luminescence material in the present invention.

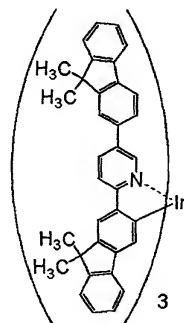
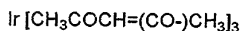
Example 2 (Synthesis of Example Compound No. 43)



In a 100 ml-three-necked flask, 1.18 g (4.98 mM) of 2,5-dibromopyridine, 3.57 g (15.0 mM) 2-(9,9-dimethylfluorenyl)boronic acid prepared in Example 1, 10 ml of toluene, 5 ml of ethanol and 10 ml of 2M-sodium carbonate aqueous solution were placed and stirred at room temperature under nitrogen stream, and 0.35 g (0.30 mM) of tetrakis(triphenylphosphine)-palladium (0) was added thereto. Thereafter, reflux under stirring was performed for 12 hours under nitrogen stream. After completion of the reaction,

25

the reaction product was cooled on an ice bath to precipitate a crystal, which was then filtered out and washed with water. To the crystal, 100 ml of methanol was added and washed at room temperature under stirring, and then was recovered by filtration. The resultant crystal was purified by silica gel column chromatography (eluent: chloroform) to obtain 2.10 g (yield = 91.0 %) of 2,5-bis{2-(9,9-dimethylfluorenyl)}pyridine (colorless crystal).



In a 100 ml-four-necked flask, 50 ml of glycerol was placed and heated at 130 - 140 °C under stirring and bubbling with nitrogen for 2 hours. Then, the glycerol was cooled by standing down to 100 °C, and 1.85 g (3.99 mM) of 2,5-bis{2-(9,9-dimethylfluorenyl)}pyridine and 0.40 g (0.82 mM) of iridium (III) acetylacetonate were added, followed by 5 hours of reflux at 180 - 235 °C under stirring and nitrogen stream. The reaction product was cooled to

room temperature and injected into 300 ml of 1N-hydrochloric acid to form a precipitate, which was filtered out and washed with water, followed by drying for 5 hours at 100 °C under reduced pressure. The

5 precipitate was purified by silica gel column chromatography with chloroform as the eluent and recrystallized from a chloroform-methanol mixture solvent to obtain 0.10 g (yield = 7.7 %) of red powdery tris[2,5-bis(9,9-dimethylfluorene-2-yl)pyridine-C³,N]iridium (III). According to MALDI-TOF MS, the compound exhibited M⁺ of 1589.6.

A toluene solution of the compound exhibited a photoluminescence spectrum showing λ_{max} = 591 nm and a quantum yield of 0.12.

15 Examples 3 - 11

Each of luminescence devices having a layer structure shown in Figure 1B were prepared in the following manner.

On a 1.1 mm-thick glass substrate
20 (transparent substrate 15), a 100 nm-thick film (transparent electrode 14) of ITO (indium tin oxide) was formed by sputtering, followed by patterning to form a stripe electrode including 100 lines each having a width of 100 nm and a spacing with an
25 adjacent line of 10 nm (i.e., electrode pitch of 110 nm).

On the ITO-formed substrate, three organic

layers and two metal electrode layers shown below were successively formed by vacuum (vapor) deposition using resistance heating in a vacuum chamber (10^{-4} Pa).

Organic layer 1 (hole transport layer 13) (40
5 nm): α -NPD

Organic layer 2 (luminescence layer 12) (30
nm): co-deposited film of CBP:metal complex (metal
coordination compound shown in Table 45) (95:5 by
weight)

Organic layer 3 (electron transport layer 16)
10 (30 nm): Alq3

Metal electrode layer 1 (metal electrode 11)
(15 nm): Al-Li alloy (Li = 1.8 wt. %)

Metal electrode layer 2 (metal electrode 11)
15 (100 nm): Al

The above-deposited metal electrode layers 1
and 2 (Al-Li layer and Al layer) had a stripe
electrode pattern including 100 lines each having a
width of 100 nm and a spacing of 10 nm (electrode
20 pitch = 110 nm) and arranged so that the stripe
electrode pattern intersected with that of the ITO
electrode at right angles to form a matrix of pixels
each having an effective electrode area of 3 mm^2
comprising 20 ITO lines bundled together at a lead-out
25 portion and 15 Al (Al-Li) lines bundled together at a
lead-out portion.

Each of the thus-prepared luminescence

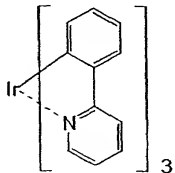
devices was taken out of the vacuum chamber and was subjected to a continuous energization (current passage) test in an atmosphere of dry nitrogen gas stream so as to remove device deterioration factors, such as oxygen and moisture (water content).

The continuous energization test was performed by continuously applying a voltage at a constant current density of 70 mA/cm^2 to the luminescence device having the ITO (transparent) electrode (as an anode) and the Al (metal) electrode (as a cathode), followed by measurement of emission luminance (brightness) with time so as to determine a time (luminance half-life) required for decreasing an initial luminance ($60 - 220 \text{ cd/m}^2$) to $1/2$ thereof.

The results are shown in Table 45 appearing hereinafter.

Comparative Example 1

A comparative luminescence device was prepared and evaluated in the same manner as in Examples 3 - 11 except that the Ir complexes (metal coordination compounds shown in Table 45) was changed to Ir-phenylpyrimidine complex ($\text{Ir}(\text{ppy})_3$) shown below.



The results are also also shown in Table 45 below.

Table 45

Ex. No.	Compound No.	Luminance half-life (Hr)
Ex. 3	6	700
Ex. 4	23	850
Ex. 5	43	950
Ex. 6	54	800
Ex. 7	72	850
Ex. 8	99	750
Ex. 9	118	600
Ex.10	153	700
Ex.11	440	650
Comp.Ex. 1	Ir(ppy) ₃	350

As is apparent from Table 45, compared with the conventional luminescence device using Ir(ppy)₃, the luminescence devices using the metal coordination compounds of formula (1) according to the present invention provide longer luminance half-lives, thus resulting in an EL device having a high durability (luminance stability) based on a good stability of the metal coordination compound of formula (1) of the present invention.

Example 12

A color organic EL display apparatus shown in Figure 2 was prepared in the following manner.

An active matrix substrate had a planar
5 structure basically similar to a structure described in U.S. Patent No. 6,114,715.

Specifically, on a 1.1 mm-thick glass substrate, top gate-type TFTs of polycrystalline silicon were formed in an ordinary manner and thereon,
10 a flattening film was formed with contact holes for electrical connection with a pixel electrode (anode) at respective source regions, thus preparing an active matrix substrate with a TFT circuit.

On the active matrix substrate, a 700 nm-
15 thick pixel electrode (anode) of ITO having a large work function was formed in a prescribed pattern. On the ITO electrode, prescribed organic layers and a 100 nm-thick Al electrode (cathode) were successively formed by vacuum deposition with a hard mask, followed
20 by patterning to form a matrix of color pixels (128x128 pixels).

The respective organic layers corresponding to three color pixels (red (R) green (G) and blue (B)) were consisting of the following layers.
25 <R pixel region>

α -NPD (40 nm)/CBP: Ex. Comp. No. 487 (93:7 by weight) (30 nm)/BCP (20 nm)/Alq 3 (40 nm)

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<G pixel region>

α -NPD (50 nm)/Alq 3 (50 nm)

<B pixel region>

α -NPD (50 nm)/BCP (20 nm)/Alq 3 (50 nm)

5 When the thus-prepared color organic EL
display apparatus was driven, desired color image data
can be displayed stably with good image qualities.

Example 13 (Synthesis of Ex. Comp. No. 24)

10 It is easy to synthesize the following
compound in the same manner as in Example 1 except for
using 2-chloro-5-trifluoromethylpyridine (made by
Tokyo Kasei Kogyo K.K.) instead of 2-bromopyridine in
Example 1.

15 Tris[2-(9,9-dimethylfluorene-2-yl)-5-
trifluoromethylpyridine-C³,N]iridium (III).

Example 14 (Synthesis of Ex. Comp. No. 25)

20 It is easy to synthesize the following
compound in the same manner as in Example 1 except for
using 2-chloro-4,5-bis(trifluoromethyl)pyridine (made
by Oakwood Products Inc.) instead of 2-bromopyridine
in Example 1.

Tris[2-(9,9-dimethylfluorene-2-yl)-4,5-
bis(trifluoromethyl)pyridine-C³,N]iridium (III).

Example 15 (Synthesis of Ex. Comp. No. 26)

25 It is easy to synthesize the following
compound in the same manner as in Example 1 except for
using 2-chloro-5-methylpyridine (made by Aldrich Co.)

instead of 2-bromopyridine in Example 1.

Tris[2-(9,9-dimethylfluorene-2-yl)-5-methylpyridine-C³,N]iridium (III).

Example 16 (Synthesis of Ex. Comp. No. 28)

- 5 It is easy to synthesize the following
compound in the same manner as in Example 1 except
that 2-bromo-9,9-diethylfluorene was synthesized from
2-bromofluorene and iodoethane in the same manner as
the process described in Example 1 at page 32 of
10 Japanese Laid-Open Patent Application (Tokuhyo Hei)
11-510535 (corr. to U.S. Patent No. 5,708,130) and
was modified into 2-(9,9-diethylfluorenyl)borate in
the same manner as in Example 1 (of the present
application), followed by reaction with 2-
15 bromopyridine to synthesize 2-{2-(9,9-diethyl-
fluorenyl)pyridine and then reaction with iridium
(III) acetylacetonate in the same manner as in
Example 1.

- Tris[2-(9,9-diethylfluorene-2-yl)pyridine-
20 C³,N]iridium (III).

Example 17 (Synthesis of Ex. Comp. No. 29)

- It is easy to synthesize the following
compound in the same manner as in Example 16 except
for using 1-iodopropane (made by Aldrich Co.) instead
25 of iodoethane in Example 16.

Tris{2-[9,9-di(1-propyl)fluorene-2-
yl]pyridine-C³,N}iridium (III).

Example 18 (Synthesis of Ex. Comp. No. 30)

It is easy to synthesize the following compound in the same manner as in Example 16 except for using 1-iodobutane (made by Aldrich Co.) instead of iodoethane in Example 16.

Tris{2-[9,9-di(1-butyl)fluorene-2-yl]pyridine-C³,N}iridium (III).

Example 19 (Synthesis of Ex. Comp. No. 31)

It is easy to synthesize the following compound in the same manner as in Example 16 except for using 1-iodopentane (made by Aldrich Co.) instead of iodoethane in Example 16.

Tris{2-[9,9-di(1-pentyl)fluorene-2-yl]pyridine-C³,N}iridium (III).

Example 20 (Synthesis of Ex. Comp. No. 32)

It is easy to synthesize the following compound in the same manner as in Example 16 except for using 1-iodohexane (made by Aldrich Co.) instead of iodoethane in Example 16.

Tris{2-[9,9-di(1-hexyl)fluorene-2-yl]pyridine-C³,N}iridium (III).

Example 21 (Synthesis of Ex. Comp. No. 33)

It is easy to synthesize the following compound in the same manner as in Example 16 except for using 1-iodoheptane (made by Aldrich Co.) instead of iodoethane in Example 16.

Tris{2-[9,9-di(1-heptyl)fluorene-2-

10090835.030602

yl]pyridine-C³,N}iridium (III).

Example 22 (Synthesis of Ex. Comp. No. 34)

It is easy to synthesize the following compound in the same manner as in Example 16 except
5 for using 1-iodooctane (made by Aldrich Co.) instead of iodoethane in Example 16.

Tris{2-[9,9-di(1-octyl)fluorene-2-yl]pyridine-C³,N}iridium (III).

Example 23 (Synthesis of Ex. Comp. No. 35)

10 It is easy to synthesize the following compound in the same manner as in Example 16 except for using 1-iododecane (made by Aldrich Co.) instead of iodoethane and using 2-chloro-5-trifluoromethylpyridine (made by Tokyo Kasei Kogyo K.K.) instead of
15 2-bromopyridine, in Example 16.

Tris{2-[9,9-di(1-decyl)fluorene-2-yl]-5-trifluoromethylpyridine-C³,N}iridium (III).

Example 24 (Synthesis of Ex. Comp. No. 37)

It is easy to synthesize the following
20 compound in the same manner as in Example 16 except for using 1-bromoeicosane (made by Aldrich Co.) instead of iodoethane in Example 16.

Tris{2-[9,9-di(1-eicosyl)fluorene-2-yl]pyridine-C³,N}iridium (III).

25 Example 25 (Synthesis of Ex. Comp. No. 44)

It is easy to synthesize the following compound in the same manner as in Example 2 except for

using 2-(9,9-diethylfluorenyl)boronic acid instead of
2-(9,9-dimethylfluorenyl)boronic acid in Example 2.

Tris[2,5-bis(9,9-diethylfluorene-2-
yl)pyridine-C³,N]iridium (III).

5 Example 26 (Synthesis of Ex. Comp. No. 45)

It is easy to synthesize the following
compound in the same manner as in Example 2 except for
using 2-[9,9-di(1-pentyl)fluorenyl]boronic acid
instead of 2-(9,9-dimethylfluorenyl)boronic acid in

10 Example 2.

Tris{2,5-bis[9,9-di(1-pentyl)fluorene-2-
yl]pyridine-C³,N}iridium (III).

Example 27 (Synthesis of Ex. Comp. No. 47)

It is easy to synthesize the following
15 compound in the same manner as in Example 2 except for
using 2-[9,9-di(1-pentadecyl)fluorenyl]boronic acid
instead of 2-(9,9-dimethylfluorenyl)boronic acid in
Example 2.

Tris{2,5-bis[9,9-di(1-pentadecyl)fluorene-2-
20 yl]pyridine-C³,N}iridium (III).

Example 28 (Synthesis of Ex. Comp. No. 146)

It is easy to synthesize the following
compound in the same manner as in Example 1 except for
using dibenzofuran-4-boronic acid (made by Frontier
25 Scientific Inc.) instead of 2-(9,9-dimethylfluorenyl)-
boronic acid in Example 1.

Tris[2-(dibenzofuran)-4-yl]pyridine-

10090036-030603

C³,N]iridium (III).

Example 29 (Synthesis of Ex. Comp. No. 147)

It is easy to synthesize the following compound in the same manner as in Example 1 except for
5 using dibenzothiophene-4-boronic acid (made by Frontier Scientific Inc.) instead of 2-(9,9-dimethylfluorenyl)boronic acid in Example 1.

Tris[2-(benzothiophene)-4-yl]pyridine-C³,N]iridium (III).

10 Example 30 (Synthesis of Ex. Comp. No. 149)

It is easy to synthesize the following compound in the same manner as in Example 2 except for
using dibenzofuran-4-boronic acid (made by Frontier Scientific Inc.) instead of 2-(9,9-dimethylfluorenyl)-
15 boronic acid in Example 1.

Tris[2,d-bis(dibenzofuran)-4-yl]pyridine-C³,N]iridium (III).

Example 31 (Synthesis of Ex. Comp. No. 150)

It is easy to synthesize the following compound in the same manner as in Example 2 except for
20 using dibenzothiophene-4-boronic acid (made by Frontier Scientific Inc.) instead of 2-(9,9-dimethylfluorenyl)-boronic acid in Example 2.

Tris[2,5-bis(benzothiophene)-4-yl]pyridine-
25 C³,N]iridium (III).

Example 32

An organic EL device shown in Figure 1C was

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prepared in the following manner.

On a 100 nm-thick patterned ITO electrode (anode) formed on a 1.1 mm-thick no-alkali glass substrate, a 40 nm-thick charge transport layer of α -NPD was formed by vacuum deposition (10^{-4} Pa) at a deposition rate of 0.1 nm/sec. On the charge transport layer, a 40 nm-thick luminescence layer (co-deposited film) of CBP: iridium complex of Ex. Comp. No. 23 (93:7 by weight) was formed by co-vacuum deposition at deposition rates of 0.1 nm/sec (for CBP) and 0.09 nm/sec (for the iridium complex) by controlling heating conditions of deposition vessel. On the luminescence layer, a 40 nm-thick exciton diffusion prevention layer of BCP (Bathocuproine) was formed by vacuum deposition at a deposition rate of 0.1 nm/sec, and on the exciton diffusion prevention layer, a 20 nm-thick electron transport layer of Alq 3 was formed by vacuum deposition at a deposition rate of 0.1 nm/sec. Thereafter, on the electron transport layer, a 150 nm-thick aluminum electrode (cathode) was formed by vacuum deposition at a deposition rate of 1 nm/sec.

The thus-prepared organic EL device exhibited an EL spectrum showing $\lambda_{\text{max}} = 545$ nm and luminescent efficiencies of 12.4 lm/W at a luminance of 100 cd/m² and 13.6 lm/W at a luminance of 600 cd/m².

Example 33

An organic EL device was prepared and evaluated in the same manner as in Example 32 except for using Tris[2,5-bis(9,9-dimethylfluorene-2-yl)-pyridine-C³,N]iridium (III) (Ex. Comp. No. 43) in place of Tris[2-(9,9-dimethylfluorene-2-yl)pyridine-C³,N]iridium (III) (Ex. Comp. No. 23) synthesized in Example 1.

The thus-prepared organic EL device exhibited an EL spectrum showing $\lambda_{\max} = 590$ nm and luminescent efficiencies of 2.4 lm/W at a luminance of 100 cd/m² and 1.9 lm/W at a luminance of 300 cd/m².

Example 34 (Synthesis of Ex. Comp. No. 54)

It is easy to synthesize the following compound in the same manner as in Example 1 except for using 4-phenyl-1-bromopyridine (made by General Intermediates of Canada) instead of 2-bromopyridine in Example 1.

Tris[2-(9,9-dimethylfluorene-2-yl)-4-phenylpyridine-C³,N]iridium (III).

As described above, according to the present invention, the metal coordination compound of the formula (1) characterized by the aromatic group of the formula (5) as a partial structure is an excellent material which exhibits a high emission quantum efficiency. The electroluminescence device (luminescence device) of the present invention using, as a luminescent center material, the metal

coordination compound of the formula (1) is an
excellent device which not only allows high-efficiency
luminescence but also retains a high luminance for a
long period and shows little deterioration by current
5 passage. Further, the display apparatus using the
electroluminescence device of the present invention
exhibits excellent display performances.

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